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THE AMERICAN
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Gasholder Foundations in Soft Soils.

[Prepared for the JOURNAL by MR. HUNLEY ABBOTT, Assoc. Mem., Am. Soc. C.E.

A gasholder foundation must support a load, distributed over a large area, where any unequal settlement will cause leakage and failure of the steel tank. Consequently, this part of the structure must be designed with special care. The steel tank has been found 33 to 50 per cent. cheaper than the concrete or masonry tank, built in after an excavation of 30 to 40 feet. With the steel tank, however, it is important that the top of the foundation be above ground water level to prevent corrosion. Before describing the foundations of the gasholder of the New Haven (Conn.) Gas Light Company, it will be of interest to refer briefly to the cost and character of several other gas tank foundations.

The handbook of "American Gas Engineering Practice," by M. Nisbet Latta, says: "The Stacy Manufacturing Company cites a recent instance of a holder (about 1½ million cubic feet capacity), erected upon soft ground, at a cost, for wooden piling, of 75 cents per square foot over the whole area of the same. These piles were capped with 2 feet of concrete, but the foundations failed immediately upon the filling of the holder tank with water."

Mr. C. A. Learned describes, in an article entitled "A Holder Foundation on Quicksand" (AMERICAN GAS LIGHT JOURNAL, Feb. 24, '02), the foundation of a holder, 115 feet diameter and 103 feet high, holding 700,000 cubic feet of gas and carrying a total weight of 9,100 tons. The soil conditions were as follows: Five feet of loam on top, then a thin layer of cemented gravel, and quicksand below that to a considerable depth. The foundation site was excavated down to the layer of gravel, and a concrete wall (5 feet high) was constructed around the circumference of the holder. Inside this circular wall was placed compacted gravel and sand, and the whole capped with a 12-inch slab of concrete. The estimated cost of this foundation is 90 cents per ton of load carried; but, from the unit costs given by Mr. Learned, it is quite probable that this foundation would cost at least $1.10 per ton of load carried to-day. No piles were used in this construction.

In the October 26, 1905, issue of *Engineering News*, a typical gasholder is described. The tank was 195 feet diameter and 39 feet 3 inches high, holding 8,712,200 gallons of water. The total load of the foundation was something under 60,000 tons. "To construct the foundation 4,100 wooden piles were driven and capped, first with 12-inch by 12-inch timbers and then 6 inch by 12 inch planks, laid tight. On this capping was laid a circular brick wall, 5 feet 6 inches thick and 8 feet deep, having an outside diameter of 199 feet. The space within this wall was filled to within 18 inches of the top with gravel, washed and rolled, the remaining 18 inches filled with concreté, on which the steel bottom of $\frac{5}{16}$-inch plate was constructed." The estimated cost of this foundation is about $1.50 per square foot and about 80 cents per ton of load carried.

"Engineering Record," for December 23d, 1911, contains an article describing the foundations of a 10,000,000 cubic feet holder, in New York city, located on the bank of the Harlem river. This foundation consisted of a circular, horizontal, reinforced-concrete platform, 4 feet thick and 258½ feet in diameter, supported on the ground, and on an annular concrete foundation wall, extending down from 5 to 45 feet to rock. This wall was 5 feet thick for the first 15 feet of its height, and below that was increased to 10 feet 7 inches. From the data given the cost of this foundation must have been about $1 per ton of load carried.

A gasholder recently built by the New Haven (Conn.) Gas Light Company, provides a storage capacity of over 3 millions cubic feet, at 7½ ounces pressure, and the guide frame will have a height (above the foundation) of 206 feet. The diameter of the smallest of the five sections of the holder will be 149 feet, 10 inches, each section being 34 feet deep. The water tank is 163 feet in diameter, 35 feet 3 inches deep with the bottom plate ¾-inch, excepting a ½-inch outer course, the side plates and fixed courses grading from 1½-inch thickness at the bottom to ⅜-inch thickness for the upper course. The tank will hold practically 5 million gallons of water and, together with the weight of this water and the weight of the rest of the structure, the aggregate load upon the foundation is figured at 30,000 tons.

Before proceeding to describe the foundation of this holder, it will be of interest to point out the original plans, and to note the great economy effected by the use of the type of foundation finally chosen, the cost of which was about 59 cents per ton of load carried.

The first plan (based on the use of wooden piles) is shown by the sketch, Fig. 4. After excavating below water level, piles were to have been driven, cut off, and capped with concrete, on which the

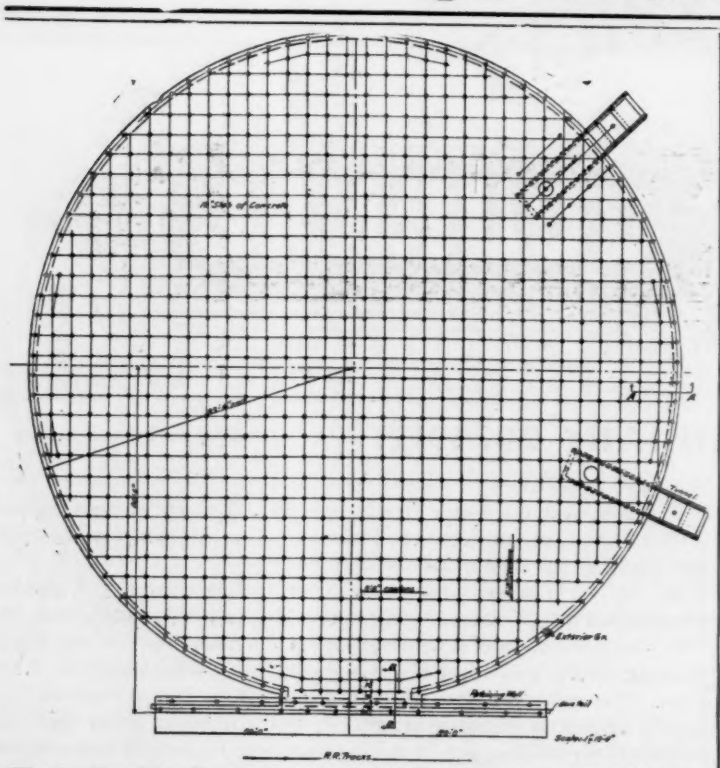

Fig 1.—Foundation Plan for Gasholder for the New Haven (Conn.) Gas Light Co.

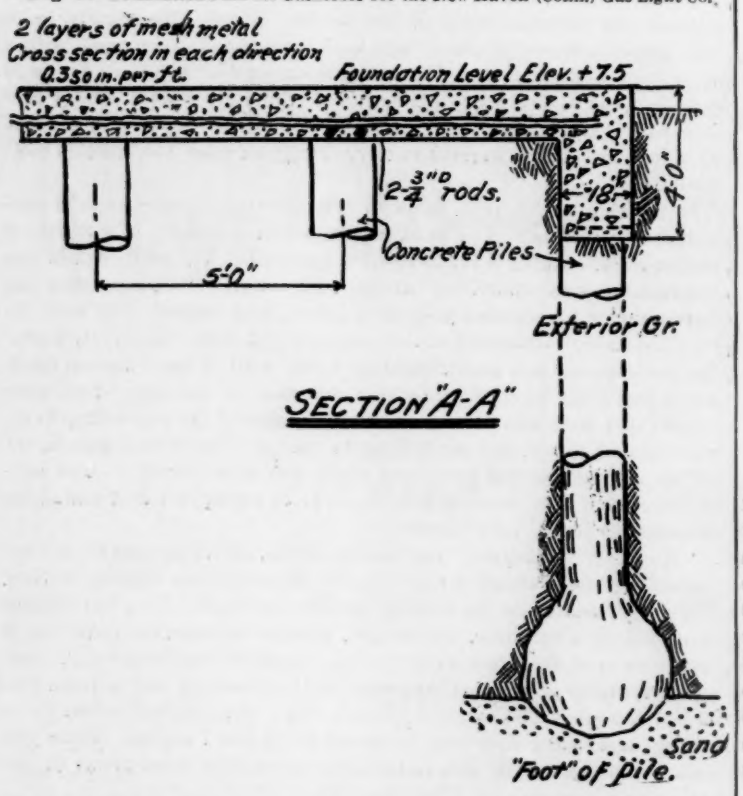

Fig. 2 —No. of piles, 966. Load per pile, 81¾ tons. All piles to be driven down to and rest on sand. Concrete in piles and pile slab, 1-2-4 mix. All other concrete, 1-2$_A$ mix

tank was to rest. Surrounding the tank was to be a retaining wall, as shown. The bottom of the gasholder tank would have been considerably below ground level, and thus, aside from the item of the cost of this type of foundation, a serious drawback would lie in the fact that the tank would be subject to the corrosive action of drainage water. The type of foundation, as actually used, consisted of pedestal concrete piles, formed in the ground with large bases, the concrete slab at the surface of the ground being well above ground water level.

Years ago the site of the foundation was a sandy beach over which a layer of mud, from 0 to 12 feet in thickness, had been deposited with a fill over the mud of from 4 to 5 feet of loose earth. The fill had been in place for a number of years. To the west of the site of the holder runs East street, and on the east of the site run the tracks of the N. Y., N. H. and H. R. R. The original surface of the ground sloped off from East street to the railroad track with a drop of about 10 feet.

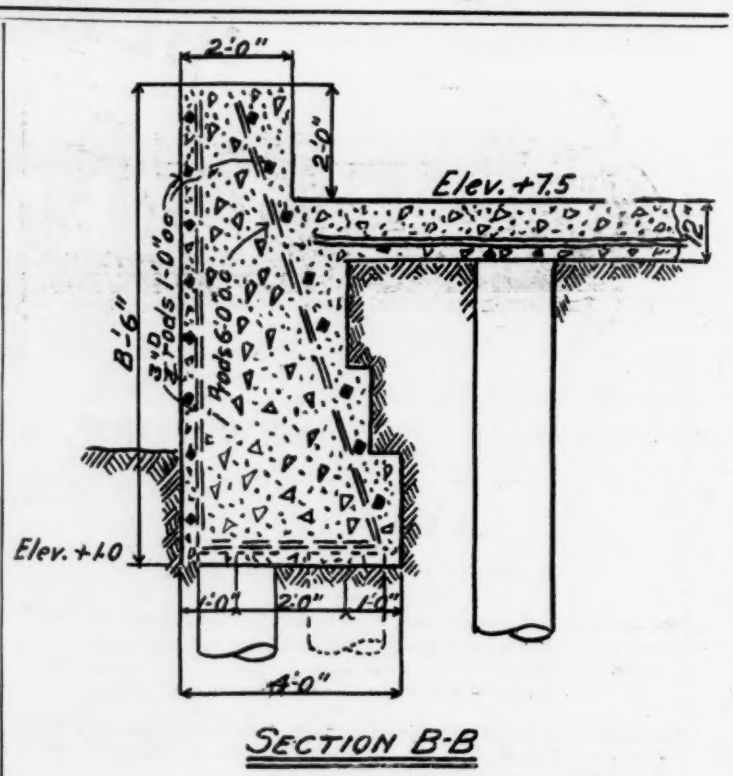

Fig. 3.

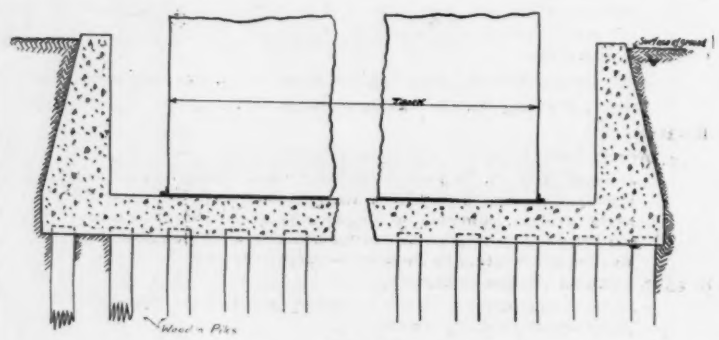

Fig. 4.

A plan-view of the foundation is shown in Fig. 1. The site was first brought to a level grade, the cut on the up-side being used as a fill on the lower side and the surface thoroughly compacted by a steam roller. Over the whole area of the foundation piles were then driven, on 5 feet centers, in all directions (as shown in the figure) 966 in all being formed, each one to carry a load of 31½ tons. The piles were of varying length, the casing and core used in formation being driven down to the subsoil a sufficient distance to insure the enlarged foot (which is bulged out in the process of making the pedestal pile) being thoroughly embedded on the sand subsoil. The pile columns are 17 inches in diameter, with enlarged footings about 2½ to 3 feet in diameter; the pile lengths vary from 10 to 30 feet.

The piles were all "cut-off" at a given elevation, and two ¾ inch square-twisted rods were run over the tops of each line of piles in both directions. Over these rods were spread two layers of 2-inch by 12-inch mesh, ¼ inch diameter, Clinton wirecloth, run in opposite directions, making two complete sheets of mesh metal over the whole foundation area. These rods and the cloth formed the reinforcing for the concrete slab disk 12 inches thick, and 66 feet 8 inches in diameter, completely covering the tops of the piles. At the outer edge of this disk is a concrete girder, 18 inches and 3 feet deep, reinforced with two ¾ inch square-twisted rods. This girder stiffens the slab on its edge where the steel tank superstructure rests, and also goes in to the earth deep enough to prevent any lifting action from frost. All concrete for piles, slab and girder was a 1:2:4 mixture, using Alsen cement. The general layout of the piles may be seen in Fig. 1, and the details of the slab and girder construction are shown in Fig. 2.

On the side of the holder next to the railroad tracks the elevation of the foundation is about 4 feet above base of rail and, therefore, a concrete retaining wall, 100 feet long, was constructed, tangent to the foundation disk and parallel to the tracks. A section through

this wall at the point of tangency is shown in Fig. 3. The wall is 4 feet thick at the base, 2 feet at the top, and 8 feet 6 inches high.

The pressure on this wall is, under ordinary circumstances, only that due to the action of the earth which it retains; but, owing to the possibility of a shock from derailment or other accidents along the adjacent railroad, steel reinforcing rods were placed as shown.

On the north side of the foundation are two tunnels to carry the 30-inch inlet and outlet gas pipes. These tunnels are 37 feet 9 inches long and project under the holder foundation 24 feet 4 inches; the inside cross-section is 6 feet by 6 feet; the bottom and sides are of concrete 12 inches thick, and the reinforced concrete foundation slab forms the roof of the tunnel. This roof is further strengthened by 15 inch I-beams at 4 feet intervals along its length. At the outer end of the floor of the tunnel is a 4 feet by 6 feet pit, 2 feet 9 inches deep, in which the cut-off valve sits.

The top surface of the foundation slab on which the tank rests was made level with a variation of not more than ¼ inch over its whole area, and an annular band around the outer circumference of the disk, about 10 feet in width, and made level to not more than ¼ inch variation. The top of the disk or slab was then covered with a mixture of dry cement and sand in equal parts, and the steel tank lowered upon this 1½-inch thick layer. The cushion of dry cement insures a uniform distribution of the load of the tank to the surface of the slab. In time the cement will harden by the moisture in the air and will form a permanent foundation, taking up any irregularities in the tank and thus insuring an even distribution of the load over the whole foundation.

The cost of the pile foundations was about 59 cents per ton of load carried, and the cost of the reinforced slab, about 44 cents per square foot. There remain to mention some features concerning the construction of the gasholder which will be of interest. A novel use will be made of the tank water as a cooling medium for the hot circulating water from nearby condensers, and the warm circulating water will assist in the winter to prevent freezing.

The holder sides of all 5 lifts are composed of 12 courses, the 8 intermediate courses between the 2 upper and 2 lower rows being of No. 10 B.W.G. steel. The double-riveted, spherical crown of the inner lift comprises 633 plates in 13 courses, concentrically arranged around a 72 inch diameter center plate 1¼ inches thick. The 9 intermediate course adjoining the first course from the center plate of No. 9, B.W.G. steel. Each lift is provided with 20 top carriages, equipped with adjustable radial and tangential rollers, and 40 bottom rollers, which maintain the vertical alignment of the holder sections during the operation of telescoping.

The 20 plate girder standards of the guide frame, which resist the wind loads and strains transmitted by the carriage rollers, are connected by 6 tiers of latticed box girders and reinforced by diagonal bracing and tie rods. Each standard, which is 171 feet in height, built up in 3 sections, tapers from 40 inches in width at the base to 26 inches at the top.

To insure thoroughly gas-tight connections, throughout the light as well as the heavy, plates were caulked during the erection stage, so that very few (if any) leaks will have to be closed when the holder is "tested." The caulking of the light sheets, while assembling, insured metal-to-metal joints, and is the most recent practice in gasholder construction, superseding the use of oxidizing agents or of inserted fillers at the seams.

The method of hoisting the guide frame members in position was on the floating derrick principle, utilizing the buoyancy of the holder sections when partially inflated with air to regulate the working height of the erection equipment. A rotating trammel derrick, pivoted on the central crown plate, with the opposite end of its radius arm carried on a circular track on the outer course of the crown, and an adjustable boom overhanging the side of the holder, were used to raise the materials into position. The lower section of the guide frame, which is 60 feet in height above the tank walk-around, was erected complete while the holder was down, and will maintain the vertical alignment of the lifts when inflated to the proper working height for raising the middle section parts into position. An eccentric load of about 8 tons will be sustained in this manner when the middle standards, weighing 4 tons each, are being erected.

The MacArthur Concrete Pile & Foundation Co., 11 Pine street, New York city, were the contractors for all the sub-structure work, including the pedestal pile foundations, and the steel superstructure was designed, furnished and erected by the Cruse-Kemper Company, of Ambler, Pa. Mr. Robert E. Wyant, of the New Haven Gas Light Company, was engineer of the work.

[Continued from Page 55.]

PROCEEDINGS, SIXTH ANNUAL MEETING, AMERICAN GAS INSTITUTE.

Held in St. Louis, Mo., October 18 to 20, 1911.

First Day—Afternoon Session.—Part I.

Discussion on the Worthing Paper.

The President said this interesting paper was before them for discussion, which he hoped would be lengthy. He asked Mr. Gartley to lead off.

Mr. Gartley said that one of the tables showed the difference in benzol content between the gas going and coming out of the washer scrubber. That, of course, showed the quantity of benzol taken out through the operation of the washer scrubber. In other words the sample was taken off from the gas as it went into the washer scrubber and passed through U-tubes set in a freezing mixture, the same being done with the gas coming out. The difference in the condensates from this shocked gas would be, it was supposed, the loss in passing through the washer scrubber. First, in experiment "A," this was 0.012 grammes of benzol per cubic feet, therefore, there seemed an unusually small amount of benzol in the crude gas. He presumed the oil used was of a paraffine base. [Mr. Worthing replied it was a paraffine base.] Again it was said, "The gas after passing through this again and being cooled, lost 1.15-candle power.

Mr. Worthing thought Mr. Gartley was under a misapprehension, for the candle power test was entirely separate from those tests for loss of benzol. The former was simply to show where the gas was pumped into the holder, then, at low temperature, pumped through a long line of mains to another holder, where it was exposed to a low temperature some days and pumped back again. At the time the gas was made, and the candle power tests were taken the intention was to show the ability of the gas to stand up under severe weather conditions; to prove it was not a tender gas.

Mr. Gartley, referring back to another page, quoted: "The test made in which the gas was allowed to stand 72 hours in an outlying holder was then pumped back to the station, during which process it had been exposed to an average temperature of 26° F., during which time it lost 1.15-candle power." In outlet gas (test "A") he had .137 grammes of benzol, or about 2 grains benzol per cubic foot, in the gas coming out of the washer-scrubber, which determination was made by passing the sample of gas through a freezing mixture in the presence of tar, which would surely take out as much benzol as could be expected to come out in the test from the holder and back again to the works. He should say Mr. Worthing, in making that test was unfortunate in not having a gas in which the virtues of the washer-scrubber could be made more apparent, for in this gas the washer-scrubber had not been proven to handle the problem of tar extraction efficiently. There was very little benzol in the gas at the start, and since 2 grains of benzol would enrich a gas about a candle, and since they were only 2 grains of benzol in the gas when it came out of the washer-scrubber, and only lost 1.15-candle power in the holder test, it did not seem that the treatment of the gas as shown in the paper was as severe as could be given it. He was not criticizing the process, which appeared to him entirely in accord with good practice, but he would say he did not think the test as made in this paper particularly proved its merits.

The President said they would like to hear from Mr. H. L. Doherty.

Mr. Doherty said the paper under discussion dealt with a process of washing and scrubbing gas of which he was the inventor. He was not responsible for bringing it before the Association and did not want to take any part in exploiting it.

The President said that nevertheless they would like to hear something more about it, to which Mr. Doherty replied that, in a general way, the results reported by Mr. Worthing were about like those reported elsewhere, and were quite like those expected. His method of treating the washer-cooler would differ entirely from the method followed by Mr. Worthing, and the speaker doubted if he could throw any particular light upon it without going into a discussion of much greater length than he would care to go at the time. To begin with there were a few principles worth special consideration. In place of circulating a large mass of cooling water in contact the gas, they circulated only the quantity of cooling water represented by the condensation coming from the gas; that is, all of the cooling water discharged from the system and that might carry away benzol or other valuable compounds was limited simply to that which is

condensed. If one brought the gas pretty well to that temperature before it entered the washer cooler, the amount of water discharged was relatively small. If one did not have to discharge any water, then the water present would soon reach saturation and then no more illuminants would be taken up. He could not answer Mr. Gartley's question off hand in grains per 100 cubic feet, as he was not accustomed to that method of calculating. One other important feature was that the system as carried out brought about the transfer of heat from water to water instead of from gas to water as usually the case. The efficiency of a heat transferring surface varied tremendously with the medium on each side. For the same general condition one may assume that the rate of heat transfer per B. T. U. per square foot per degree per hour will be about 1½ B. T. U. when transferring heat from gas to gas. Transferring heat from gas to water will secure a transfer of 2½ B. T. U. square feet per hour. Working from water to water, in which one process transferred heat through a diaphragm from water to water, one gets an efficiency of heat transfer of about 150 B. T. U. per square foot per hour; that is, with clean gas and clean water. Working with a fouled gas and impure water, one could get as low as 39 B. T. U.; in fact, could get a deposit so thick that it would be even lower than that, but the lowest he had gotten so far was 39 B. T. U. That meant a much smaller equipment and less surface, and as one got direct contact between water and gas, one could get just as large superficial area there as wanted, and finely dividing the streams of water and gas, bring about just as intimate a mixture between the gas and water as was wished. That was a system of washing and cooling which they had gotten up for use practically in their own plant. They had not tried to exploit it, simply using it as a means of cutting down the amount of scrubbing and condensing surface to the getting of better condensation results. The Semet-Solvay Company used it quite extensively. They found they could use it if desired as a tar extractor, in addition to using it as an ammonia scrubb r, etc. In other words, they could cause this apparatus to take the place of every other piece of apparatus between the hydraulic main and the purifier, although they were not advocating the practice. The system as set forth here was applied to water gas and the complete system as applied to coal gas was very much more extensive than was the literature on the subjects, so it would be an injustice to the system to describe it in an impromptu talk.

Capt. McKay said he was much interested in the results of this washing and scrubbing system. The Boston Company had satisfactory service from the cooling of water gas with the so-called "salt water" tubular condenser. Practically the same space was occupied as that noted in the author's paper. A condenser of that size would efficiently care for between 450,000 and 500,000 cubic feet per hour. It would cool the gas to 90° or 100°, or to the temperature at which they wished to deliver it to the P. & A. tar extractor. Regarding the operation of this Doherty cooler-washer, the author stated that the water required was only one-thirteenth that necessary for the old-time tubular condenser. He asked Mr. Worthing whether that included also the water used to cool the circulating water. The author further stated that he calculated a saving of 7-horse power per hour, but in computing that had he included the horse power used in pump ing the water to cool the circulating water? If these items had been included in both cases, was the author able to state how much water was used respectively in the circulating and cooling systems, also how much horse power was used in the circulating system, and how much to cool the circulating water?

Mr. Klumpp said that the author gave a table showing the relative heating value and candle power of the gas after treatment with this scrubber-washer. The heating value seemed high, compared with the candle power, showing evidently a very low oil efficiency, and after exposure the slight drop of candle power showed that the quantity of benzol thrown down was very small. It seemed that the oil efficiency of the gas as made could not have been much over 5.4 candles per gallon, and the gas after exposure had an efficiency of nearer 5 candles per gallons, which meant, he thought, that the gas had very little benzol in it in the first place; wherefore there was very little benzol to lose in the scrubber-washer. It would be interesting to know the oil efficiency, as he would look for a much greater loss in candle power (probably 2 or 3 candles) if the efficiency were around 6 candles per gallon.

Mr. Russell said he was also looking for enlightenment. At one point in the paper it is stated, "Tar per 1,000 cubic feet, gas separated in washer-cooler equals 0.096 gallon, or 0.80 pound, or 363 grammes tar per 1,000 cubic feet of gas." Now, assuming that oil tar formed was about 10 per cent. of the oil used, and assuming 3.8 gallons of oil per 1,000 cubic feet, they would have a total oil tar product of about 3,800 gallons. The author states the washer-cooler is only taking out .096, or roughly, 25 per cent., of what might be expected ordinarily in water gas practice. He supposed that washer-cooler was located between the relief holder and the seal. Undoubtedly there was some loss of oil tar in the seal and possibly in the pipe leading up from the washer-cooler, but the discrepancy seemed very large. Either their measurements were not accurate or the washer-cooler had not taken out anything like the amount of tar the paper would lead them to believe. On several points he would like information. First, he should like to know, for instance, as to the table, page 10. Were these actual gas temperatures as going into the holder at Station A, and the temperature of the gas coming back to the holder at Station A? Also, how these holders were flushed, and it would also be important to have the analyses of the gas, both going and coming, as regards the benzol contents. Again, it would be important to know whether any hygroscopic tests were made showing what the minimum temperature was which the gas actually reached at any time in the main. All these were things which should be brought out before any really intelligent discussion of the paper could be had. The author also used the term "condensate" as though it was something rather fixed, that you removed the condensate and there was the end of it. He was not quite clear what was meant by the term. Was it synonymous with tar vapors, or not? He inclined to think from the paper that the author gave an impression that the condensate was all taken out in the washer-cooler, but such would not be the case.

Mr. Worthing said, regarding the first question, the saving of horse power included in the calculations to force the water through the cooling coils, if that was what Capt. McKay meant. The cooling coils were right on the line of the washer-cooler. The water was brought up from the well, forced through the cooling coils and from these into the first section of the washer. Of course, that horse power was taken into account in calculating the horse power saved.

Capt. McKay interjected that was not his question. After the body of circulating water had cooled, had the author calculated the horse power to make that water cool the circulating water?

Mr. Worthing said they had calculated roughly the total quantity of water pumped by the works' pump, and that part of it was used for cooling the circulating water, and calculating therefrom the horse power consumed in pumping the cooling water. The figure of 1/13 —that is, the washer-cooler used 1/13 of the water required in the old form of condenser—the figure taken before they put on the extra cooling coil. That would be now somewhat modified, but not very materially, especially in the winter time. Concerning the oil efficiency in this test of the ability of the gas to hold its candle power at a low temperature, he would say the oil efficiency was nearer 6 than 5½, and although they did not make as high candle power gas as that shown in the test, consequently they did not expect, under the circumstances, to get such high oil efficiency as they would if making a lower candle power gas. At the same time, there was no marked diminution beyond what you could expect for the candle power maintained, hence there was no reason for thinking that the gas was especially lacking in benzol. As to Mr. Russel's first question, they never used as high as 3.8 gallons per 1,000; at least, very seldom. The oil ran ordinarily much lower; second, the washer-cooler was located between the relief holder and the boxes, so the tar had excellent opportunity to deposit in the seal and in the relief holder. In fact, the heavier amount of tar came out before rather than after the relief holder, and at considerably higher temperature. All the condensate, that is, all the tar and heavy oil left in the gas at the outlet of the relief holder, came out in the washer-cooler. None got by at all; at least, not while they had sufficient cooling water. They took no analyses of the gas in this test to determine the ability of the gas to stand up, but the gas stood in an open holder, exposed to atmospheric temperature for 72 hours, and it was pretty certain to come to that temperature; in fact, he did not see how it could help doing so. Furthermore, the holders were flushed by pumping gas into them. They let the holders down as low as possible, then pumped gas through the mains into the holders and out until it was thought the holder had been sufficiently flushed. The holders were flushed with a very considerable amount of gas, so that at the end of the tests they had but a little over ½ the gas they had at the start. He did not think it at all surprising to get as small a quantity of benzol out of the gas as they did, for the difficulty of getting an average sample of unpurified gas was so great as to be almost impossible. They do not know to

what extent the candle power was lowered by these freezing tests, very slightly, probably, according to the figures for the gas in the endurance test. Moreover, the quantity of benzol gas could retain at the minimum temperature to which it was subjected in these tests was very considerable, hence the part taken out only represented it as likely a small part of that actually in the gas. The tests were merely comparative. If there were any loss in benzol it would be due to that absorbed by the condensate in the washer-cooler. He did not think that this test showed the actual amount of benzol originally present in the gas. As to the estimation of benzol loss calculated from the amount present in the tar, he would say it was as nearly as possible candle power benzol. It was distilled from a large quantity of tar, and the resulting oil was re-distilled by the ordinary method until they got a product of practically uniform boiling point; that is, candle power benzol Did that answer Mr. Gartley's question?

The President said a point which he would like to have brought out caused him to ask Mr. Gartley if the speaker was right in holding that the former thought gas washed with saturated water would lose more benzol than would be lost in passing the gas through an ordinary condenser at the same temperature, assuming the water to be saturated with the illuminants that the gas contained.

Mr. Gartley replied in the negative.

Mr. Doherty said he did not like to break the rules of discussion, but one very important point not brought out might be of advantage to place before the attention of others. He had found, in holding the candle power it was very valuable to get the tar out of contact with the gas circulation, and by using a type of machine like this, the one under consideration, the tar was seldom long in contact with the gas. Settling in the basin to the bottom of the cooled chamber it was not so exposed as in the tar extractor where the surface kept on absorbing the illuminants. In this process the tar was precipitated from the gas and was separated from further contact with the gas by a superimposed layer of water. The tar did not came back into the circulation, but the water did.

Mr. Gartley suggested a method of condensation brought to his attention within the last year. The loss of benzol was a functioning of two, temperature and contact with tar. If the tar in the condensers were flowing downward against a current of gas going upward, in which the tar would meet with the warmer gas, a dephlegmatic process was going on; but, as the author said, in a case of that kind one would not be able to determine to what extent it went on or how much good it was doing. That apparatus seemed to him to answer pretty nearly every requirement. After the gas left the holder and before going into the main, it passed through a dephlegmatic column by means of a fan blower, and, bubbling up through that column, it met eventually with a temperature that would reduce it to the lowest temperature obtaining in the main. As it dropped its condensate and its vapors, and went down through the column, the warm tem perature encountered while going down caused a re-vaporation, the lighter material rising again to the top until the gas going off would be necessarily freed of all the water that it would drop in the main, which would be determined by maintaining the temperature of the gas going off at the temperature of the main, by means of the hydrometer. They would also have in it every bit of vapor in the gas as it entered the dephlegmatic column, and it would stay in the gas at the lowest temperature it met with in the main. If such a condenser were put into practice and worked through rigidly, one could get a gas that would not give any condensate after it got into the mains. Of course, you would find that it might be found too expensive, since one might be cooling a million feet of gas to a temperature in which there would be a small portion of the heat in some remote place, where the main came unusually near the surface. In this condenser another thing could be done. Wanting to enrich by benzol, it was apparent that, if the benzol were admitted according to its gravity (according to its purity) if it were admitted at different points in such column, the dephlegmatic process would go on in the enriching benzol, wherefore the heavy material would all be kept behind and every bit of the valuable enriching properties would go off with the gas and stay there. He thought that was the nearest to perfection they could reach, for if they were going to mix gas with water at a temperature, say, below 105° they were bound to get some of the condensate that would come out with the water. Mr. Worthing was very fortunate in having so lean a gas. Had he carried out his experiments with such a gas as was obtained from oil from the Beaumont field, he would undoubtedly have a small amount of benzol vapor (perhaps 10 times as much) in which the chances for the loss of candle power might be 5 or 6 candles. They did not get that oil now, so they were not giving anything away at the present time. However, he might have found he would have had in the water that came out, after the gas had gone to 105°, a large amount of benzol.

At the suggestion of the President (and an motion of Mr. Gartley) a vote of thanks was passed to Mr. Worthing.

(To be Continued.)

(Concluded from page 57.)

Insulation as a Means of Minimizing Electrolysis in Underground Pipes.

[Prepared for the Sixth Meeting, American Gas Institute, by Dr. E. B. Rosa and Mr. Burton McCollum.]

It is well to call attention at this point to some of the various types of insulating joints that are now in use. These may be divided into four classes, viz.: (1) Clamped joints using a rubber gasket or other insulating material to make a tight joint and provide the insulating section; (2) wooden joints, including wood stave pipe sections; (3) cement joints, of which there are various types; and (4) leadite joints. The first of these, exemplified by the well-known Dresser and Hammon couplings, is quite extensively used for the purpose of securing gas tight joints, and some types of these are designed also to give insulating joints. When properly designed and installed, it gives a very high resistance joint, and has been very effectively used in a number of instances for the purpose of reducing the flow of current in the pipes. The construction of one form of Dresser coupling, known as the divided center-ring, insulating coupling, is shown in Fig. 9. Both of these types make very satisfactory insulating joints

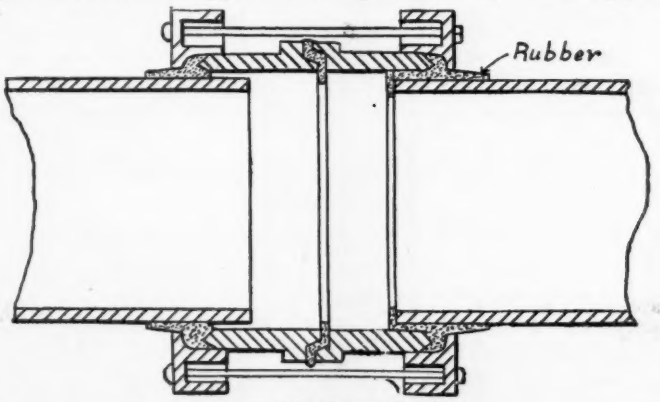

Fig 9.—The Dresser Coupling.

for most purposes, although they may, under certain circumstances, be liable to injury because of the relatively short leakage path, the importance of which has already been discussed. Under most circumstances, where the local potential gradients are not too high, this should cause no trouble. Some trouble has been reported where these couplings have been used on artificial gas mains owing to the deleterious effect of the gas on the rubber gaskets. They do not appear to be affected by natural gas, however, and in such mains they appear to show a satisfactory life.

Of the wooden joints numerous modifications are in use. One type used by the Pennsylvania Water Company is shown in Fig. 10 which

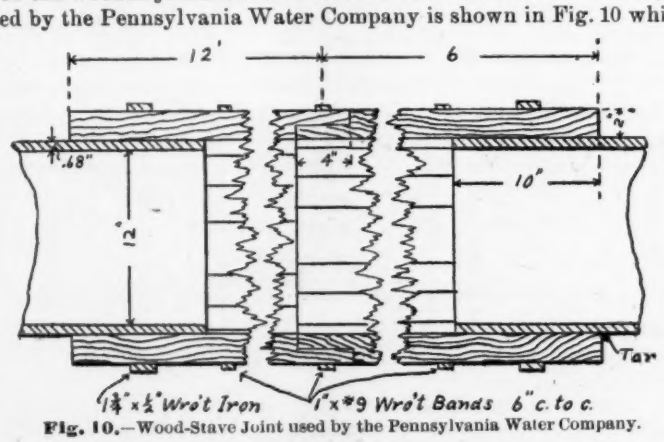

Fig. 10.—Wood-Stave Joint used by the Pennsylvania Water Company.

is self explanatory. This joint has a high electrical resistance, and is particularly adapted for use in places where only one (or at most a few) joint is installed and the drop of potential across the joint is likely to be high. The great length of the joint is very effective in causing any leakage current around the joint to distribute itself over

a considerable length of adjoining pipe, as pointed out above, and thus prevents concentration of electrolysis at the edge of the joint.

Another type of wood-stave joint is shown in Fig. 11. The spiral

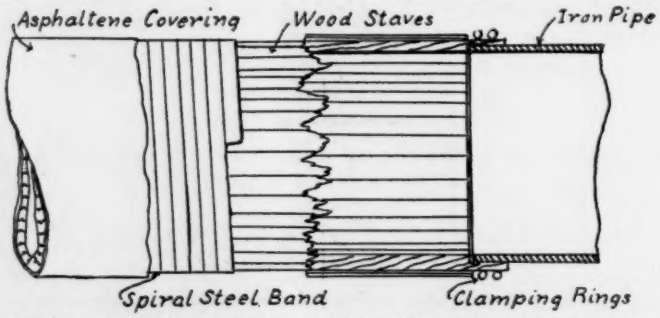

Fig. 11.—Construction of Wyckoff Stave Pipe Showing Connection to Iron Pipe.

steel band used in this construction would have the effect of materially shortening the leakage path, and while it would have ample resistance to serve as an insulating joint under most circumstances, it could not safely withstand as high a drop of potential across the joint as the one described above.

The Metropolitan Water Board, of Boston, uses a type of wooden joint, shown in Fig. 12. This joint is simple in construction, con-

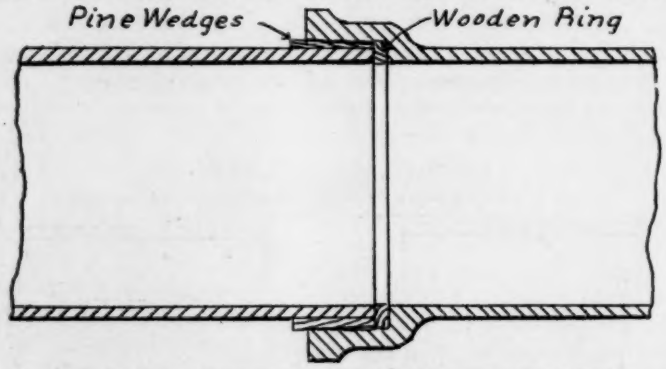

Fig. 12.—Insulating Joint used by the Metropolitan Water Board, Boston.

sisting of a ¼-inch, wooden-liner, made of overlapping section of wood, the ring thus formed being wound with canvas impregnated with paraffine, The purpose of this is to prevent possible metallic contact between the ends of the pipes. The wooden staves are of clear, white pine, planed to fit the curvature of the pipe, and are driven in by a special driver to prevent splintering. Any leaks that may develop are stopped with white pine wedges. These joints have been found very satisfactory up to about 75 pounds pressure. Higher pressures sometimes cause moderate leakage through the pores of the wood, and this has been overcome by dipping the inner ends of the staves in redlead. In some cases the staves are reinforced by an iron band clamped around the spigot end of the pipe. Usually a slight change is made in the castings where this joint is to be inserted, the spigot end being cast without bead and the inside of the bell smooth without groove. The cost of these joints has been given as ranging from $5 to $12 when installed in new lines, but when installed in old mains the cost would be much higher. The resistance of this joint is ample under all circumstances that may arise, but the relatively short leakage path would often make it necessary to use the joint with greater frequency than would be necessary with joints having a long leakage path.

Cement joints have been given a variety of forms, and one which has been used succesfully for years by the Cambridge Gas Light Company, is shown in Fig. 13. In making this joint the inner ring

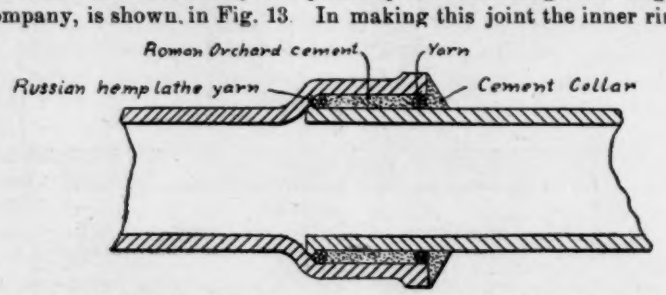

Fig. 13.—Cement Joint used by the Cambridge (Mass.) Gas Light Company.

of hemp is chosen exactly the right size to fill the annular space between bell-and-spigot, and this is rolled in when the pipes are set together and driven hard with the calking tool. As usually done by the Cambridge Company, no special attempt is made to keep the metal of the two adjacent lengths of pipe apart; but, notwithstanding this fact, the resistance of the joints has on the whole been high enough to prevent the accumulation of any considerable amounts of stray currents. As a consequence this system has never been troubled by electrolysis, although the pipes of the Cambridge Water Company have suffered severely. After thoroughly tamping the ring of hemp into the place the cement is carefully worked into the joint with trowel and calking tool, until the space between bell-and-spigot is filled flush with the face of the bell. Another turn of hemp, the same as the first, is then laid against the cement and driven in with the calking tool just under the edge of the bell. The cement is in this way rendered very dense, and on this feature depends in large measure the success of the joint. A collar of cement is finally laid over the outer ring of hemp to protect it from rot. If success is to be achieved with this joint, great care must be exercised in the making of the joints. Perfect cleanliness of the inside of the bell and outside of the spigot is necessary, and all loose scale and sand should be removed before the cement is put in place. Only the best quality of cement should be used, and this should be thoroughly mixed and tamped into the joint with the greatest care. Careful bedding of the pipes is equally important, as the cement joint is much less yielding than lead, and if any considerable lateral movement of the pipes takes place it is liable to break the pipe, the strength of a well made joint being as a rule greater than that of the pipe itself. In some instances, instead of making every joint of cement, every third or fourth joint only is made of cement, the others being lead. Except in extreme cases this seems likely to prove practically as effective in minimizing electrolysis troubles, and it has the great advantage that the lead joints impart a flexibility to the system that will greatly reduce troubles due to lateral motion of the pipes.

The use of leadite joints has been confined chiefly to water mains, and for such service many prefer it to any other type of joint. This material is melted and run into the joint after the manner of a poured lead joint. It is cheaper than lead, and many claim that it makes a better joint mechanically. It often happens that when the joints are first made a large proportion of them will show considerable leakage; but in the presence of water they seem to have a tendency to seal themselves up, and the leaks will usually cease entirely within a day or two. It is very important to see that a dense mass completely fills the joint, and it is lack of care in this respect that is probably responsible for most of the trouble with leaky joints. The runner used in pouring the joint should be so designed that there will be a head of 8 inches to 10 inches above the joint. If the material is at proper temperature this head is usually sufficient to insure a dense, homogeneous mass of leadite in the joint. As already noted the resistance of leadite is very high when first run; but, after lying in the ground for some time, its resistance decreases greatly. As to whether this will continue to such an extent as to render it worthless as a resistance joint cannot be stated at the present time, but the material appears to possess interesting possibilities and should be carefully studied.

In attempting to reduce the damage from electrolysis it must be borne in mind that best results are not to be derived from the application of any one method of mitigation alone. Whatever the system that may be applied to the pipes, it is of prime importance to give proper attention to the condition of the tracks and negative return system generally, since the difficulties encountered in connection with any system of protection will be reduced in proportion as the drop of potential in the rail return is lowered. Since, however, as the conductivity of the negative return is increased, and the drop of potential in the negative return is brought to a relatively low value, further reductions can be accomplished only at relatively great expense, and after a certain point is reached it will be more economical to apply further protective measures to the pipes themselves. It is of first importance, therefore, to have sincere co-operation between the pipe companies and railway companies, if the most effective measures are to be applied at the minimum cost to all parties.

Conclusions in regard to matters pertaining to electrolysis mitigation must be drawn with great caution, and much additional work must be done before very definite judgments can be formed in regard to many of the problems referred to above, but a careful review of the situation, as regards the methods of protecting pipes by insulation, seems to warrant the following conclusions:

1. The insulating paints thus far tested deteriorate much more rapidly when subjected to electric stress than when the electric stress is absent, and such paints should not be depended upon to protect

pipes against electrolysis unless they have been thoroughly tested under conditions which subject them to electric stress.

2. Insulating paints, because of their tendency to fail locally, and thus concentrate the discharge of current, may do actual harm, and should, therefore, not be used in those regions where the pipes may be expected to become strongly positive to the earth.

3. In all places where the pipes are likely to remain negative or neutral to earth, no harm can result from local failure in reducing current flow in pipes and in preventing soil corrosion.

4. Where insulting joints are properly used the pipes do not, as a rule, have a very strong tendency to discharge current into the earth, and in such cases paints may be safely used to prevent soil corrosion.

5. The rapid deterioration of paints under electric stress is due to the fact that a trace of moisture finds its way through the coating, thus permitting a feeble current to flow resulting, at first, in very slight electrolysis. The formation of gases with other products of the electrolysis then causes rupture of the coating and the formation of blisters.

6. Laying of pipes in conduit or embedding them in cement is not to be recommended as a protection against electrolysis, it being a useless expense.

7. Insulating joints, when rightly used, can be made very effective in minimizing electrolysis.

8. Those who have had most experience with insulating joints to date regard them as economical and entirely practical from a mechanical standpoint.

9. Insulating joints should be carefully made to insure permanent insulation.

10. Insulating joints should not be confined to positive areas, but should be installed in all places where there is any considerable potential gradient parallel to the pipes, and should be installed with sufficient frequency to prevent any considerable current from flowing in the pipes, and so that a dangerous potential difference cannot occur across the joint.

11. The effective resistance of a joint depends not alone on the resistance of the joint proper, but also on the resistance of the leakage path in parallel with the joint. For this reason the effective resistance of a joint increases very slowly with increase of length so that short joints are practically as effective in reducing flow in pipes as very long joints.

12. Long joints give a much more uniform distribution of leakage current, and hence less rapid deterioration of the adjoining pipes than do short joints, so that in special cases, where it is necessary to have a high drop of potential across the joints, a long joint is to be preferred.

13. If pipe lines containing insulating joints are connected to mains not so insulated the insulating joint immediately adjoining the uninsulated line will, as a rule, be subjected to higher differences of potential than elsewhere. This is particularly true if negative feeders are connected to the uninsulated main. For this reason the use of insulating joints and negative feeders on the same pipe system is not to be recommended.

14. Where insulated and uninsulated systems occupy the same territory, and where it is necessary to have metallic contact between them, as inside of buildings, an insulating joint, placed between the point of contact of the two systems and the point where the insulated system enters the earth, will be of great value in preventing current from flowing from the uninsulated into the insulated system.

In presenting the forgoing preliminary report on certain phases of of our work to date we recognize that there still remains a vast field in which investigational work must be continued for an indefinite period before we can hope to advance our knowledge of this complex and troublesome problem to the point which the great economic importance of the subject demands. In continuing our work, relating to this and other phases of the electrolysis problem, it is important that we keep as closely as possible in touch with the gas, water and electric railway interests, in order that our work may be carried forward along most effective and practical lines. Any communications from engineers dealing with any phase of the electrolysis problem will, therefore, be welcomed and appreciated.

In conclusion we wish especially to express our obligation for valuable co-operation to the following named persons:

Mr. W. C. Hawley, Gen. Sup., Pennsylvania Water Co., Wilkinsburg, Pa.

Mr. J. G. Pew, Vice-Pres. and Gen. Mgr., Peoples Gas Co., Pittsburgh, Pa.

Mr. C. Sholl, Superintendent, Apollo (Pa.) Water Co.

Mr. Geo. C. Gensheimer, Sec. and Treas., Erie (Pa.) Water Dept.

Mr. J. B. Crawford, Gen. Mgr., Pennsylvania Gas Co., Oil City, Pa.

Mr. Raymond Cross, Gen. Supt., Pennsylvania Gas Co., Oil City, Pa.

Mr. A. M. Blinn, Local Mgr., Pennsylvania Gas Co., Erie, Pa.

Mr. F, W. Stone, Superintendent, Ashtabula (O.) Gas Co.

[Concluded from Page 64.]

PROCEEDINGS, SEVENTH ANNUAL CONVENTION, NATIONAL COMMERCIAL GAS ASSOCIATION.

Held in Denver, Col., October 24 to 28, 1911.

Third Day—Afternoon Session.

Discussing the paper by Mr. Blinks.[1]

The President said he thought they had been highly favored in having such an excellent paper as that prepared for them by Mr. Blinks. They could easily determine that thought and study had been put into it, and it was filled, from cover to cover, with excellent statistics of value. He asked for discussion on it, and hoped the members in their speeches would be pithy rather than prolix.

Mr. Peck said he wished to speak a word of encouragement as to the future of gas lighting as seen by him. They all believed, in the matters of cost, color, convenience and æsthetic features, gas was holding its own at the present time in the field of lighting. The opportunities for improvement were, however, vastly greater with gas from the following point. The photometrical equivalent of white light was 7/100 watts per candle, so the "Gem" carbon lamp, consuming about 3½ watts per spherical candle, came down to an efficiency of 2 per cent., and the more efficient tungsten lamp, at 1½ watts per candle, gave a real efficiency of only 5 per cent. The best electric arc, taking approximately ½ watt per mean spherical candle, gave an efficiency of 14 per cent., and the inverted gas mantle, consuming about 6.4 cubic feet per candle power, reduces this to 12 watts per candle power, or an efficiency of .6 per cent. There was no reason why the electric generating price should be reduced any more than the cost of gas at the present time. However, they had an opportunity of improving the efficiency of gas lighting from .6 per cent., while in the electric field the efficiency was so much higher there was less chance of their increasing the efficiency. They should endeavor to bring the efficiency up; then they would not have to discuss the matter as often as now.

Mr. Elliott said he wished to briefly make two points. Everything considered, the relative cost of electricity and gas figured out like this: Gas at $1 per 1,000 was equivalent to electricity at 4 cents, and any material difference over this depended upon local or special conditions, so they knew about what they had to figure with. If electricity could be furnished for less than 4 cents, they had lost their lead, but if electricity cost more than 4 cents, then they had the advantage. The tungsten lamp cut their lead ½ over the lead before the tungsten came in. That is, their lead from 6 to 8 was cut to a trifle over 2, a lead that could be easily overcome by inefficient or faulty engineering. The other point concerned the question of quality of gas mantles as against that of incandescent electric lamps. The latter had been brought in this country to a standard of excellence that led the world, the electric interests having spent probably in excess of ½ million dollars per year perfecting the electric lamp and bringing its quality to a uniform standard. The electric lighting interests and the central stations were instrumental in this through insistence on giving to their customers the best and most uniform product possible of obtaining. Comparing the statistics of electric standards with this, there simply was not any standard at all. A difference of a cent in the cost of a mantle would generally (entirely in too many cases) throw the purchase in that direction, regardless of the quality of the mantle. If they expected to keep the present lead they must have uniformly good, high grade mantles. He believed the artificially built mantle that was coming into use would be of greater service to them in retaining their lead than that afforded even by the inverted burner. The main defect in the mantle was its fragility, and when that had been advanced, possibly to the point where it would stand up as well and hold its candle power as well as the tungsten did in these respects, their hold on their lead was absolute.

Mr. Norman Macbeth said he could approve the last three or four

1. For the text of the Blinks' paper, see *ante*, p 57.

(*Continued on page 76.*)

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NOTICE TO ADVERTISERS.

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NEW YORK, MONDAY, JANUARY 29, 1912.

[Official Notice.]

Forty-second Meeting, New England Association of Gas Engineers.

New England Association of Gas Engineers,
Office of the Secretary,
East Boston, Mass., Jan. 1, 1912.

The Forty-second Annual Meeting of the New England Association of Gas Engineers will be held Wednesday and Thursday, February 14th and 15th, 1912, at Young's Hotel, Boston.

Papers are being prepared on:

High Pressure Distribution. Gas Office Buildings. Industrial Appliances. Producer Practice in Water Gas Making. Shavings Scrubbers. Measurement of Flow in Mains. And on other subjects of interest.

Members will dine together Wednesday evening.

Those who wish to join the Association should send in application to the Secretary before the meeting. N. W. Gifford, Secretary.

[Official Notice.]

Annual Meeting, Illinois Gas Association.

Illinois Gas Association,
Temporary Office of Secretary,
Dixon, Ills., January 17, 1912.

To the Members, Illinois Gas Association: The next annual meeting of the Illinois Gas Association will be held in the Auditorium Hotel, Chicago, under dates of March 20th and 21st, 1912. Announcements as to papers to be discussed will shortly appear in this Journal.

F. E. Newberry, Secretary.

BRIEFLY TOLD.

January Meeting, Philadelphia Section, Illuminating Engineering Society.—A regular meeting of the Philadelphia Section, Illuminating Engineering Society, was held in the Philadelphia Electric Company's premises, 1000 Chestnut street, the evening of Friday, the 19th inst. The attendance at the dinner which preceded the session was 108; and the meeting proper, which was called to order at 7:50 P.M. by Chairman J. D. Israel, was attended by 243 members and guests. The programme was commenced with an educational talk by Prof. A. J. Rowland, Director of the School of Engineering, Drexel Institute, whose clever 15-minute speech on the theory of the origin of light waves, sound waves, and the like, was made quite plain to his audience by means of a few demonstrations through the aid of simple apparatus. The regular paper list for the evening contained two numbers, the subjects of which were in a measure correlated. The first was by Mr. V. R. Lansingh, whose theme was "The Architect and the Illuminating Engineer;" the second, on "Illumination of Interiors by Daylight and by Artificial Light," was prepared by Mr. L. B. Marks. It might be remarked that the address subsequently delivered by Mr. E. L. Elliott (the Editor of "The Illuminating Engineer") should have been dignified with a special caption; that thought seemed borne out when the three gentlemen were awarded special votes of thanks for their contributions, and especial commendation for having journeyed from New York to be on hand at the Philadelphia January assembling. Mr. Lawrence Vissacher Boyd (an architect of prominence) and Messrs. W. J. Serrill and R. B. Ely took prominent part in the discussions which the set topics brought about. The debate was followed by an attractively presented biograph picture series portraying "The Home Electrical." Another technical chapter that was well worth while was an exhibition of gas meters, with oral description thereof, by Mr. W. A. Castor, Superintendent of Meters, United Gas Improvement Company. The meeting was the largest one held by the Philadelphia Section, and Secretary Eichengreen (to whose attention we are indebted for the facts in this connection) writes: "We consider ourselves fortunate in having had with us at this meeting the founders of the Society, Messrs. Lansingh, Elliott and Marks." Just before adjournment (11 P.M.) a photograph of the "meeting in session" was successfully taken.

January Meeting, New England Section, N. C. G. A.—The January meeting of the New England Section of the N. C. G. A., was set for 8 P.M., of last Friday, in Wesleyan Hall, 56 Bromfield street, Boston. The special feature of the meeting was to have been a paper by Mr. James P. Conroy, the clever and successful representative and manager of the interests of the General Gas Light Company in this section of the country. Mr. Conroy's theme was "The Gas Arc Lamp and Its Possibilities," and lantern slides were to have aided him in his describings. No other man in the Eastern States (or, for that matter, in any other compassing of the country) is better qualified to speak on this subject than Mr. Conroy, and while the Journal for the week will be on the press beds when Mr. Conroy is going on with his lecture, we will here venture the prediction that Mr. Conroy held the close attention of his hearers to the very end.

February Meeting, Illuminating Engineering Society, N. Y. Section.—Mr. A. J. Marshall, Secretary New York Section, Illuminating Engineering Society, advises us that the February meeting will occur the second Thursday evening, the 8th prox., at 8:15 prompt, in the United Engineering Societies' Building, 29 West 39th street, New York city. The paper of the evening will be: "Choice of Reflector: Its Influence on Illumination Efficiency and Depression in Visual Function," by Arthur J. Sweet and L. C. Doane. The paper is to set forth results of researches extending over a period of many months, and will prove interesting to analyze. It is possible that a second paper will also be given.

Gas and Electric Efficiencies.—The academic discussions of the relative efficiencies of gas and electric lighting units, which formed so large a part in the discussions of the Denver convention of the Commercial Association, may be largely summed up in the question of maintenance. The initial installation-efficiency is easily 2 to 1 in favor of gas, and when this ratio does not continue the trouble is mainly one of maintenance. An aggressive policy of supervision and maintenance of consumers' appliances, of all kinds and for all purposes, is an essential part of the efficiency of modern apparatus. And this is exemplified in the manufacturing end more and more each year. Better results go hand-in-hand with better facilities for testing and checking the make in both the manufacture and the purification of the product, with the good resultant benefits of increased yield, better quality and decreased costs. The benefits of more frequent supervision of customers' equipments by higher trained workmen will not only hold safe that now in hand, but open up new fields through the agency of goodwill. Manufacturers are spending millions on advertising to increase the interest in their products, and nothing else will increase the advances in the use of gas as much as an appliance that is operating efficiently. It is a silent salesman of potent value; but, in order that the desired results be obtained, the appliances must be of the best. And this state can only be attained

when companies make it their business to see that all customers are impressed with the knowledge of the many advantages of modern apparatus and to then maintain it. Unless this is done the manufacturer of inefficient, but cheap, apparatus has an easy opportunity to unload his wares upon the unwary. Such installations can only prove harmful "investments" for any company, since if they do not cause the consumer to abandon the use of gas altogether, they take him out of the asset column and put him among the liabilities. A right valuable asset in the possession of a company is the goodwill of its consumers, and if one is to progress one must use modern apparatus, and modern apparatus must be maintained until its adjustment and care are understood by the user.—LUMINO.

ANNUAL MEETING, AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.—The 18th annual meeting of the American Society of Heating and Ventilating Engineers was held in New York, January 23d to 25th in the Engineering Societies' Building. The registered attendance was well over 200, and the sessions never lacked interest, the discussions being especially noteworthy for snap and worth. One session was given over to the subject of ventilation, and many professionals were invited to discuss the topic, whose opinions in the main were widely divergent. The subject of "Gas Lighting and Ventilation," was shared in by Mr. H. Thurston Owens, who remarked: The gas manufacturers were in the business of causing ventilation quite as largely as those connected with the American Society of Heating and Ventilating Engineers, the apparatus of the former consisting of gas in combustion for light, heat and power. The heat produced increased natural ventilation in a marked degree, and many men in the industry who had seen it so successfully perform this function often wondered at the efforts that were being made to compulsorily enforce ventilation laws. It was the opinion of many that, should a building be so constructed as to cause a large increase of carbonic acid gas at the breathing level in rooms where gas was used for lighting, provision should be made for forced ventilation without reference to the quantity of gas consumed, the basing to be preferably determined by the number of people and their occupation. An exhaustive investigation of this subject, made in London, by Dr. S. Rideal, was reported in a paper read by him before the Royal Sanitary Institute (1908) as follows:

"(1) Owing to the better ventilation obtained by gas, the products of combustion are not found in the air in anything like the proportion which might be expected, the temperature and humidity in an occupied room being no greater than when the room is lit with electric light.

"(2) Carbonic acid has not the injurious effect which was formerly attributed to it, but considerable rises in the temperature and moisture content of a room, from whatever source, do have a prejudicial effect upon the well-being of the occupants. Even under adverse conditions of ventilation purposely created for this inquiry, neither the temperature nor percentages of moisture in the room reached a point at which any such effect could be detected by any of the recognized physiological tests.

"(3) It has been established that the products, viz., heat, carbonic acid and moisture, so far as they modify the health of the occupants of a room, are derived from the inmates more than from the illuminant, and that a room of moderate size can be efficiently lighted by gas without sensibly affecting the amount of these three factors.

"(4) Whilst undoubtedly it is important to ensure adequate ventilation in domestic rooms, this, with present methods of construction, is better ensured the smaller the room. The problem of securing sufficient ventilation in public rooms of a larger size has been outside the scope of this inquiry.

"(5) The medical conclusions are in accord with those arrived at from the chemical and physical data, and also demonstrate that the choice between the two systems of lighting does not depend upon hygienic considerations."

While it seems generally understood that CO_2 from combustion is not harmful in small quantities, it is important to note that, in a report covering a period of 5 years, Dr. J. S. Haldane and his associates recommended that the standard for ventilation in rooms where gas is used for illumination be as follows, the proportion of CO_2 at the breathing level not to exceed 20 parts in 10,000 volumes. It is to be hoped that these investigations will receive further attention from those working toward bettering the conditions in factories, and I am sure that the gas industry stands ready to welcome suggestions and to co-operate towards bettering hygienic conditions even to the point of reaching the smokeless, dustless city.[1]

CURRENT MENTION—

MR. A. F. BLOSSEY, Superintendent of the Alton (Ills.) Gas and Electric Company since 1906, has resigned from that service. A temporary successor ("Bert." England) has been appointed to succeed him.

THAT miserable misrepresentative of a Metropolitan New York City Sentorial District, possibly in the hope that the days of 1903 may be restored to him in some measure, in his connection with the gas interests of New York city, last week introduced a bill in the Senate directing that the price of gas in any part of New York city, when such price does not exceed 80 cents per 1,000 feet, shall not exceed 70 cents per 1,000 cubic feet. While it is not at all likely that the measure has any chance of becoming a law, it is nevertheless a queer travesty on the law abiding manufacturers of this city that their properties are subject to the attacks of such a member of the community as Sullivan is. He might as well as not be here given anew the information that the days of "killing bills in committee," are forever at an end, in so far as the gas companies of Greater New York at least are concerned.

AT the annual meeting of the Consolidated Gas Company, New York city, about 75 per cent. of the total shareholdings had personal representation. The proceedings were directed by Mr. William Nelson Cromwell, and the retiring Board of Trustees was re-elected. An adjournment, after routine matters were disposed of, was ordered to the 20th prox. Some features of interest from the annual reports are appended: The report, which has to do with the Company's operations for the twelvemonth ended December 31, 1911, shows: An operating income of $3,025,358, against $3,046,448 in 1910; total income of $8,016,281, against $7,851,446; a surplus of $7,551,877, against $7,416,479, or 7.56 per cent. earned on the $99,816,500 capital stock, against 7.43 per cent. earned on the same stock a year ago; and a profit and loss surplus of $11,502,853 as compared with $10,631,272 in 1910. The balance sheet shows assets of $147,728,896, as compared with $145,286,475 at the end of 1910. In his remarks to stockholders, President George B. Cortelyou says that during the year average gas sales per customer decreased 2.37 per cent. and average electric sales decreased 3.22 per cent. The first decrease in consumption lessened the Consolidated's gross earnings by $408,000 and those of all the gas companies by $525,000. The loss to the electric companies through the greater economy of electricity users was $761,000, making $1,286,000 lost because customers used less service. At the end of 1911 there were in use 848,266 gas meters and 189,691 electric meters. Combined sales of gas by all companies were 27,861,658,609 cubic feet, a gain over 1910 of 2.37 per cent. Sales of electricity were 333,376,469 kilowatt hours, a gain of 14.49 per cent. Paper bag cooking came in for some of Mr. Cortelyou's words to the stockholders. He said that the demonstrations of how to cook thus have attracted so much attention that there has often not been room enough for all the standees who wanted to see the trick done. The increase of emergency calls was 17.03 per cent. At the meeting of the Directors, held the 25th inst., the former officers were re-elected, and a dividend of 1½ per cent. for the quarter was declared.

MR. E. EYSENBACH, General Manager, Consolidated Gas Company, Long Branch, N. J., since 1898, has resigned that position. His successor is Mr. Frederick R. Cutcheon, of St. Paul, Minn. Mr. Eysenbach was tendered a farewell dinner at the Hotel Imperial, Long Branch, the night of the 20th inst., by his former associates, and the guest of honor was Mr. Cutcheon.

THE Gas Machinery Company, Cleveland, O., has been awarded a contract for the placing in the works of the Mobile (Ala.) Gas Company, the following apparatus: A 36-inch ammonia concentrator; a No. 8 exhauster, and silica retorts and settings, complete, for 3 benches of 6's (inclined type of construction), which order is the second one received from the Mobile Company for retorts and settings of the sort noted.

LUCIEN L. SHEDDEN, who will be remembered as one of the Board of Commissioners of Gas and Electricity (1905) appointed by Governor Higgins, which body became famous or otherwise in the final establishing of an 80-cent gas rate for New York city, and respecting the advocacy of which he was persistent, died at his home in Plattsburg, N. Y., the morning of the 17th inst. He was in his 63d year, having been born in Malone, N. Y., April 21, 1849.

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1. *References.*—"The Relative Hygienic Values of Gas and Electric Lighting;" Dr. S. Rideal, "Journal of the Royal Sanitary Institute," London, England, Vol. 29, No 2, 1908; "Report of Department Committee on Factory Ventilation;" London, May 17, 1907.

(*Continued from p.* 73.)

lines of the last paragraph in this paper—that part relating to gasoline competition—although perhaps not in the exact manner intended by the writer. "How much gasoline competition on your lines may be considered legitimate, and how much more may be due to errors of commission and omission on the part of some one either now or at a time past on the company's payroll?" He did not think there was any doubt, at least so far as he had been able to find out by personal investigation, that gasoline competition was most often caused by unsatisfactory service, whether gas or electric. The average consumer was very prone to do without a gasoline plant, if he could do so properly and save his face. Satisfactory illumination could be furnished at so reasonable a price to-day, and of such a quality, that the amount of money saved through the use of gasoline could hardly be the real consideration. It always seemed to him the strongest points lay in the quality and convenience columns rather than in costs. Good gas or electsic service always costs more than gasoline; but it was always worth it. He had never seen comparative costs in which he had any confidence that were not favorable to gasoline, and he did not believe they should fool either themselves or their salesmen on that point. In discussing the balance of this paper, which could very well have been given the usual title of "Comparative Illuminants," he might be allowed some privileges, inasmuch as he was perhaps largely responsible for the attack on the "Competitive Illuminant Report" before the National Electric Light Association meeting last June. He was sorry to say that, in his opinion, this report was not any better. He did not want to be destructively critical, but there were statements in this paper leading to the inference that the writer had much conclusive data which could, no doubt, have been used and which would have been more to the point than his unsupported personal opinion, supplemented as that was with tables copied from the various publications, practically all of which were either old or referred to lamps not in use in this country. That part of the N.E.L.A. report, referring to lamp maintenance costs, was simply set aside with the statement: "I can refer to thousands of lamps where the cost is but a fraction of the figures given." His own opinion was that there were fewer gas men who believed that lamps could be properly maintained for 6 cents per mantle per month than of those who had that knowledge. To simply say, "'Taint so," is not at all conclusive. Another criticism of the electrical paper was that laboratory conditions were given on the electric lamps and working conditions on the gas lamps, which situation was not bettered in this paper, for the gas lamps there referred to were also practically all under laboratory conditions. He was sorry to see, in a paper of this kind, which was presumably a defence of gas against the field, that a gas man still had time to fight with his nearer competitor in the gas lighting side of the industry. Why shouldn't all gas men stand together in meeting a common enemy? Standardization is highly desirable, if only in tests. The photometric curves on the bottom of page 21 were evidently inserted to show that a certain 3-mantle, inverted arc is as good as another manufacturer's 4-mantle lamp. When the gas men got together and effected some kind of standardization that style of comparison would no longer be fashionable. Photometric curves of gas lamps could not be used for comparison as regards light output, unless the 2 lamps to be compared were tested on practically the same gas, in the ame laboratory, at the same time and with a gas of which something definite was known. The author of the paper was undoubtedly very well aware of how a very fine showing can be made by a photometric investigation and a distribution curve with a lamp which is equipped with "flash" mantles and adjusted to the very finest point. Lamps in service could not be expected to be subject to any such adjustment, nor would many of the lamps when so adjusted continue to show as high an efficiency, even for 24 hours. As a consequence, the statement made on pages 16 and 17, that gas lamps give only ½ of the efficiency under average working conditions was not a "high-handed brand of reasoning," but one which would aid gas men in the delivering of that intensity of illumination which might be contracted for, certainly to a very much greater extent than an absolute dependence upon such a photometric curve as that shown on page 21 for the 3-mantle lamp. Of the tables given, practically all referred to European conditions. He found but one table, with the exception of the tables presented by and referring to the N.E.L.A. report, in which the least reference was given to conditions in this country—that was the table from the *Electrical World*, April 1901, page 5. Referring to the *Electrical World*, they would find the greater part of this table was taken from a German publication of 1904; but they all knew of the enormous advance made in illuminating engineering lines in the last 3 or 4 years. His impression from reading the paper was that the author was very well satisfied with the gas situation, inasmuch as the costs were apparen tly all favorable to gas. Practically all of these tables were on the basis of mean spherical candle power, but now they did not sell either gas or electricity on the basis of mean spherical candle power. If they did, then the writer should have referred to more of that table from the *Electrical World*, and should have gone down into the higher efficiency inclosed arc lamps, the quartz lamps and the flaming arcs, the latter of which has cost of 0.21, as compared to 0.72, for the cheapest gas proposition. In other words, the cheapest gas proposition was nearly 3½ times as expensive as the electric. If installations were sold on the mean spherical candle power basis, then the only source which would be entitled to attention on the electric side would be the flame arc, and on the gas side the old upright mantle arc. He knew, as doubtless many members here also knew, of salesmen who have taken out flame arcs and have replaced them with inverted gas arcs which gave satisfactory service to the consumer—the light output was not one-fifth as much and the costs were not appreciably different, and that was the point he wished to make; sell service and the right lamp for the location, judged solely on the basis of satisfactory illumination for that location. If one proceeded, however, with a mean spherical candle power comparison, one considers his installations more from the imitation standpoint and with the assumption that the installation one desires to replace was satisfactory from an illumination point of view. As the writer says: For a furtherance of his arguments you can refer to any length of published literature; also that one can secure tables to bring out almost any point desired. That was true; and he was reminded by the table, published on page 6, of a papor given by Prof. Scott, before the Southwestern Gas and Electric Association (May, 1910), where a life test was carried on with reflex lamps. The average candle power of these lamps was shown to be about 24, and it was further reported that one mantle got a hole in it at 200 hours, and burned out (?) at 400 hours. Surely there was not a gas man present who would place any dependence upon that paper, even considering the fact that it was prepared by a college professor. On page 8 the statement occurs: "It so happens just now that the mazda lamp, unshaded, throws nearly one-half its light above the horizontal; therefore, the flux of light or total lumens is pronounced the proper measurement." Any member at all in touch with the lighting end of the business knew the light sources were rated in mean spherical candle power or total lumens, for practically every committee on photometric standards and recommendations, both here and abroad, decided such was the proper method of rating a light source; furthermore, that practically all of these decisions were made a matter of record long before there was such a unit as a magda lamp. A statement made on the bottom of page 12 and top of page 13 is that "The manufacturers have produced burners and mantles which will not depreciate 30 to 40 per cent., as asserted, if given the attention that their claims as revenue earners entitle them to." He believed it would be of information to gas men generally if Mr. Blinks would state just what in his opinion that attention should be, especially in view of the fact that he states that lamps will operate at 80 to 90 per cent. of laboratory efficiency. The speaker's idea of the term "laboratory efficiency" was that reference was made to the photometric curves secured in laboratory investigation, but he could not believe Mr. Blinks would make the statement that the attention that gas lamps are entitled to was such that lamps would be kept up to 80 or 90 per cent. of the light output, as shown by the photometric curves which he published, for instance. He agreed that any reasonable attention would keep a lamp pretty well up to the same efficiency under which that lamp would operate if used in the illumination of a laboratory—in fact, that that efficiency could be very easily improved upon. Lamps used in laboratories most generally suffered from neglect and were only given the most necessary kind of attention. He would like to know what tests, if any, had been made which would justify the conclusion that lamps may be kept up to 80 or 90 per cent. of their light output, as shown by the laboratory figures issued by the lamp manufacturer? There were many foot notes in this paper which have been given considerable weight because they were taken from electrical publications. He thought the condition should be recognized that these were old publications, and that the situations generally described in them did not strictly apply to the lamps as put out by the manufacturers to-day. The fragility of the tungsten lamp (referred to several times), when considered from the standpoint of the lamps in use 2 or 3 years ago, had been done away with. The manufacturers, for instance, were no longer packing lamps in cotton bat-

ting in separate boxes and again suspending these boxes inside of a shipping case in such a manner that practically all jar would be done away with. Many of the tungsten lamps as shipped to-day were packed in small, corrugated paper carbons, similar to those used for many years with carbon filament lamps. On the question of cleaning lamps and reflectors, perhaps too much weight had been given. Electric incandescent lamps and reflectors should, of course, be cleaned, but it was very seldom indeed that they required cleaning more than once a month, in some cases once every 3 or 4 months; and in all cases it was that part of the lamp or reflector which could be seen that required the cleaning. There were no concealed or hidden parts which, if they become dirty, will interfere with the efficiency of the unit. "To clean a lamp" we may agree, but there was little similarity in the statement appliod to both gas and electric lamps. Another point that should not be lost sight of, in comparative cost of gas and electric service, is that, when considered on the basis of 10-cent electricity and $1 gas, the statement may be made that electricity for equivalent illumination has a cost of 2½ times that of the gas. That statement was quite as bad as that (made by the N. E. L. A. report mentioned) a pilot would consume 30 per cent. of the total gas consumed by the lamp. Of course, in that report the statement was qualified by giving the number of hours' use of the lamp and the consumption of both lamp and pilot; nevertheless that statement had been used by other writers without such qualification. He also felt that a statement on comparative costs, that one was 2½ the cost of the other, would be used in the same way, whereas that would not be true with $1.50 gas and 4-cent electricity. Dollar gas was pretty close to the minimum rate in use in this country, whereas 10-cent electricity was nearer the maximum, and there were many services in use where the rate did not exceed 2, 3, 4, 5 or 6 cents. Statements of a general nature of that character should be very carefully handled indeed. In the case of the pilot consumption, there were many instances where, in place of the pilot accounting for 30 per cent. of the charge it might be 2 per cent., and in some cases 2,000 per cent., depending upon how much or how little the lamp was used. If it were necessary to spread before the proceedings of this Association a paper of that kind, he was very glad to see it done now, for the sooner these papers on comparative costs became ancient history the sooner they would be able to get to an understanding of conditions as they are, and secure information which would be valuable and useful to all.

The President asked Mr. Blinks to close the discussion.

Mr. Blinks said he realized in bringing this paper before them that it would not be possible, in the limited time permitted for its preparation, to make the very complete comparisons that we would like to have on all points of competitive cost. But the point they ran against, most particularly in talks with gas men, had been causing this habit of the electric interests to claim nearly full initial efficiency for their lamps, and to calmly rate gas lamps at about ⅓ power as fair working value. He attempted to show that electric light depreciation in service was apt to be fully as great as that normally present in gas service. He regretted not having at hand data proving that gas lamp operation would not run less than 90 to 80 per cent. of initial efficiency, but hoped to present the results of actual tests in the near future. He thought too, this was so generally accepted by gas men as to need no proof in this paper. The *Electrical World* matter referred to had no intentional bearing on the fragility question, being simply inserted as further proof that electrical maintenance was as necessary as gas maintenance, without which either service was sure to run down in quality. It was asked what attention the revenue producing value of a gas lamp entitled it? He would answer that the lamp, whether single burner or arc, should be kept in the best possible working order all the time; mantles in good condition; glassware clean, burner gauzes free from corrosion, etc. When in that shape it was sure to be used with such gratifying results to the consumer that the gas sales would justify the maintenance cost involved. A well cared for gas lamp was an advertisement before their customers all the time. Reference had been made to the possibility of obtaining abnormal candle power values with so-called "flash" mantles and burner adjustment at just the balanced point where the mixture was on the point of flashing back. The tests he referred to were not made in that way. The mantles were of regular quality, and the photometer readings were never made until lamps had burned at least ½ hour, as maximum efficiency is usually not obtained in less time. As to costs it was his belief that the gas arc lamp with gas at $1 would compare favorably with electric current at 2½ cents. In this discussion costs w ere continually referred to, because this was the text assigned, but gas lighting did not appeal exclusively on economical grounds. Gas companies in this country were doing a thriving business in lighting against 4, 3 and 2½-cent current. The merits of gas lighting, aside from price, had been discussed time-and-again, and the records were full of it. He was sorry there was not time to bring out more general discussion. The value of a paper was not in having everyone agree with it, but in serving as a starter from which diverse opinions might be called forth, and the collective wisdom of the attendance allowed to offset the necessarily less broad experience of the writer.

A Coast Boom.

Mr. Newbert (San Francisco) said they, of the Pacific Coast, were very anxious that the Association should hold its meeting there in 1915, and since this meeting had been in session he had heard some favorable expression to that end. He, therefore, would like at this time to introduce the following resolution: "*Resolved*, That this Association and its membership will use all reasonable efforts to secure the holding of the Convention of the National Commercial Gas Association, in the year 1915, in conjunction with all other gas Associations, in order to have a general convention of all organized gas associations which may then be in existence, in the City and County of San Francisco, in the year 1915; in commemoration of the completion of the Panama Canal, by the World's Fair, to be held in said City and County of San Francisco, by the Panama-Pacific International Exposition Company." He moved the adoption of the resolution. [Seconded by Mr. E. L. Elliott.] The motion was put and declared adopted.

Mr. C. O. Bond on Surface Combustion.

The President introduced Mr. C. O. Bond, of Philadelphia, who presented the following anent the topic of surface combustion:

Mr. President and Gentlemen: It has been suggested that I make a resume which would last from 5 to 7 minutes, and in this paper, I have endeavored to so do. The Chairman requested me to prepare a short resume of a lecture on a technical subject. I am glad that this Association welcomes such subjects. We must remember that, while the commercial men are on the firing line making good use of the ammunition, and that back of them are the men who manufacture the guns and ammunition with which they fight, yet back of both are the students and the laboratories from whose research emerge improved or wholly new weapons that may change the whole tactics of battle. Out of the laboratory came the incandescent electric lamp, and an industry valued in the hundred millions was built upon it. Out of the laboratory came the mantle and a resuscitative gas industry resulted. We have listened to-day to a further improvement in mantles, born in a laboratory of research. Had you gentlemen attended last week's meeting of the American Gas Institute, at St. Louis, you would have learned of another laboratory victory which is bound to have a marked influence on many of the gas appliances of the future. I refer to the phenomenon of "Surface Combustion," a demonstrating lecture[1] upon which subject was delivered by Prof. W. A. Bone, of Leeds University, England. A pamphlet containing this lecture will soon be issued by the Institute and each of you should get a copy and become familiar with the subject. We must understand at first that what we call a gaseous explosion is a relatively slow process, built up by a series of molecular explosions within the explosive mixture. The rate at which this mass explosion occurs is at least a million times slower than the rapidity of molecular explosion. The temperatures reached within the area of molecular explosion are extremely high as compared with those we customarily assign to gaseous combustion. It has long been known that certain substances, when slightly heated in the presence of a combustible mixture, had the property of accelerating the union of the components by a kind of condensation on their surfaces, where the reaction became intensive and higher temperature resulted. This is a catalytic effect, and we are familiar with it in the example of the hot wire igniter, in which platinum is used in hydrocarbon combustible mixture. Now, Professor Bone shows that a like acceleration of combustion takes place by the use of *any* solid surface immersed in the mixture. It demonstrates this by using two similar cylinders filled with electrolytic gas and maintained at the same temperature, about 100° C. below the temperature of ignition. One cylinder is void of solids, the other is filled with marbles or broken fireclay, or the like, for the purpose of increased solid surface. A manometer tube, connected to each, indicates the relative rates of slow combustion by a change in pressure, and that in the packed cylinder is found

1. See Journal, *ante*, Dec. 4, 1911, p. 355.

to be markedly faster. The energy that is liberated upon gaseous combustion manifests itself in three forms: Radiation, convection and conduction. When this combustion is made use of in our appliances and a poor economy is obtained, the losses are usually through convection and conduction. Professor Bone argues, therefore, that we should increase the radiation percentage, and his studies have been to that end. This is brought about by the intensified combustion of a perfect mixture of gas and air. This mixing (in one case shown) was effected in the chamber behind a porous diaphragm, the combustion taking place on the front surface of the diaphragm in a layer so thin and so intimately in contact with that surface as to bring it to a high state of incandescence. This surface then becomes a highly efficient radiator of energy, having the excellent property that the direction of radiation can be varied at will, the diaphragm being portable. Rapid surface evaporation of liquids was demonstrated, and the possibilities of efficient broiling pointed out. In a form adaptable for furnaces the gaseous combustion was completed in a bed of broken or porous fireclay surrounding the retort or crucible to be heated, a temperature being obtained in one demonstration which melted platinum—about 3,300° F. In another form, the combustion was effected in tubes filled with the broken surfaces, these tubes being immersed in the material to be melted, such as lead; or in the liquid, such as water, for the generation of steam. With the lead melting pot, 68 per cent. of the energy of the gas was utilized to the end sought, the products of combustion escaping well above the melting point of lead. With the steam boiler described, and starting with water at 60° F., steam was supplied at 120 pounds pressure in 20 minutes time, and close to 90 per cent. of the energy of the gas was available as steam, the spent products being used to heat the feed water during continuous test. A large boiler has recently been built in England to give this method a practical test. The advantages in quickness of raising steam and in floor space saved are at once obvious. In the several forms mentioned it should be remembered that combustion is absolutely perfect and complete, and that analysis of the spent products fails to show any unconsumed combustible. In fact, the radiating diaphragm mentioned maintains to incandescence undiminished when plunged into an atmosphere of carbonic acid gas. My purpose in making this brief reference to the above subject is that inspiration may be taken for the future of the gas business. While the savants are still studying the nature of gaseous combustion and of gaseous explosion, while gas engines convert on an average not more than 25 per cent. of the gas energy into power, and while the luminous rays from the mantle represent only ½ of 1 per cent. of the gaseous energy expended, there is plenty of room to hope and to work for a good advance in efficiency and for a vast increase in the usefulness of our product.

On motion of Mr. Cohn [seconded by several] a rising vote of thanks was presented to Mr. Bond for his excellent presentation of the subject of Surface Combustion.

Introspective and Retrospective.

Mr. G. W. Clabaugh said: Mr. President and Gentlemen—Indeed, our lines have been laid in pleasant places, for it has been put up to me to place the laurel wreath upon the brows of those men who have made this Association what it is, whilst they live. Obituaries are all right in their place; but, gentlemen, let us commend those whom we respect, those who have done so much for us and for this Association, that history may repeat itself in the years to come. For, if we do not take it up now, at the time we are making history, we will learn, with Kinsley, who has so beautifully said:

"So fleet the works of men,
Back to earth again,
Ancient and Holy things
Fade like a dream."

We do not want that with this Association. Little did Mr. Bigelow think, when he planted that acorn but a few years ago, that the mighty oak would have arisen to-day. That oak has been watered by all the members of this Association, and particularly by those who have taken so active a part in it, until to-day it's branches cover the entire continent in its membership, and as the acorns fall, each year is added one more member to this Association. Now, gentlemen, this Association has not grown of itself, it has come up from the work and the works of men. Men who have given their time, their energy and their ambition, that this Association may be one of the greatest, one of the noblest, and the most ennobling in this whole country. It is most fitting that this meeting should be held in this Hall. Perhaps you do not know that on this spot, as near as can be determined, met the Arapahoe Indians, in council many years ago, and we are meeting to-day in council, that posterity may know what we have done and, taking our example, may uplift and go on and move forward this Association, until, as I have said before, it will be the greatest existing exponent of the industry in the country. Gentlemen, we have many workers here, and it is not necessary for me to mention them. They have all been eulogized before, but we cannot say too much of a good thing or a good man, or good men. Just see what our President has done this last year. Think of the work he put into this Association, that we might come here and enjoy its privileges. He knew when he was elected what we had—a precedent had been established that was hard for any man to live up to. I can say truthfully, and I think you will all agree with me, that he has not taken a step backward, and this meeting has equalled any other meeting that this Association has held, and he too has established a precedent for his followers. The Entertainment Committee has done everything within its power to add to our pleasure, and no matter what the years may bring forth in other places, no matter how cordially and how great the entertainments may be, they may equal, but cannot surpass, the entertainment given us by the Denver Gas and Electric Light Company. [Applause.] The entire city of Denver extended a cordial welcome to us. We have accepted their hospitality, and there has not been a moment of our time here that we have not enjoyed ourselves, and we can take back with us, in the sweetest memory, these days that we have spent together here, in mingling one with the other. To Mrs. Frueauff, who has given so much of her time and her beautiful personality to the ladies who have come here, we owe a vote of thanks. She and her committee have added much to their entertainment, without which I doubt if they would have known what Denver's hospitality could possibly have been. [Applause.] Mr. Frueauff, Chairman of our Membership Committee, accomplished wonders by the tremendous enlargement of the membership for the past year, and to him and to his co-workers we extend a most hearty vote of thanks. I cannot pass here without saying something about that genial fellow—our friend—your friend—Mr. C. Willing Hare, who has given his time, personality, energies and intellect for the past years toward building up this Association. To him is due, largely, the great membership that we now have. Mr. P. S. Young, who unfortunately is not with us. To him we extend our hearty thanks, for he is always at the wheel, ready and willing to do his share to the upbuilding and uplifting of our Association. The Chairman of the Paper Committee has thanked all those who have prepared papers, and, gentlemen, if there are any here who have done something for this Association, let us individually give them thanks for the hearty work that they have done. We who have been but privates in the ranks, the men behind the guns uphold them, and shoot straight, so that some day the enemy may be ours, and we, with victory's crown upon our brow, may lead forth the greatest and the grandest Association for the improvement, not only of men, but of people, in this whole beautiful and glorious country of ours. Gentlemen, a new President has been elected, something that this Assembly Hall never has been able to do before; they nominated a man, but they did not elect him. We have nominated a man and have elected him unanimously, and now in the year to come let us uplift and uphold his hands and do as we have done before, that this precedent established here may be kept up for the years to come. Gentlemen, I personally cannot leave this hall without thanking those who have made it possible for me to enjoy one of the grandest times I ever had. Coming back to Denver after an absence of 24 years, I scarcely knew the place. Its beauty was started then and it has been continued, until it is to-day one of the most beautiful cities in this most beautiful land of ours. And as long as those snow-capped peaks crown your city with their grandeur, you can look the world in the face, and say: "With all your Alpine beauty, and with your Alpines, nothing will ever surpass this, the grandest city in these United States." [Applause.]

Secretary Stotz followed with a number of announcements, and the President, in declaring the business sessions at an end, said: If there are no other matters of business to come before the convention at this time, I would like to give my personal thanks to those who have so ably sustained the Administration in its endeavors during the past year. Without exception, every time I asked for assistance, from any member of the Association, regardless of whether that member was an officer or not, and whether or not he was on a committee, this assistance has been immediately forthcoming; so, gentlemen, if the Association has been successful during the past year, it is simply due to your own efforts and the splendid assistance and co-operation given

your President. To the manufacturers I think, we are indeed indebted; and I trust that we may show, in a substantial manner, our appreciation. They have given us a splendid exhibit, have come long distances, and are spending money in advertising their wares and educating us to the better uses of gas in its various forms. I trust, as I have said before, that, by our presence and by the interest we take in their exhibits, we will demonstrate to them that these exhibits are well worth their while. The various officers and directors have been very liberal with their time and money during the past year, traveling in some instances hundreds of miles to attend meetings, and they deserve our hearty thanks. The various committeemen and the chairmen of the committees have spent an immense amount of time and labor, and if I were able to tell you of the vast number of letters which have been written, you would be amazed at the correspondence which has passed back-and-forth between the members of this Association, in the transaction of business. This is only one item, which I mention, others might be mentioned which would make as great a showing. I want to second the remarks of Mr. Blyler, Chairman of the Paper Committee. The papers presented were of a high order and were greatly enjoyed, and my only regret is that we have not had an unlimited time for their discussion. I trust at the next convention this matter will be so arranged that ample time will be given for the reading and discussing of all of the papers. I feel that we are particularly indebted to the committees mentioned by Mr. Clabaugh a few minutes ago, and in addition to the committees mentioned by him, we are, I feel, very fortunate in receiving the nominations of the Nominating Committee. We have officers for the ensuing year who are bound to lead this Association to future success, and I predict unhesitatingly that our growth will be rapid, and not only rapid, but that the work accomplished will be worth while. I feel, through the action taken by the Committee appointed on the President's address, that such steps will be taken in the future, and in the near future I hope, that will enable the Association to greatly enlarge its scope of usefulness. Therefore, gentlemen, these various companies mentioned, I am positive, will result in continued rapid growth and advancement, and the expansion of our Association, of which we are justly proud. I want to say, also, that I am particularly pleased in the selection of the next convention city. The gentlemen from that city who are with us, and the officers of the Company who were unable to attend the convention, but are at home, I think are deserving of the compliment paid them when we decided to hold our next convention in the South; and, gentlemen, I trust all in attendance at this convention, together with many who are unable to be with us at this time, and together with the new members who I am sure will be secured in the near future, may all have the pleasure of meeting at this Southern convention city. In closing, gentlemen, I simply want to say that my advice is, "On to Atlanta." [Applause.] I declare the convention adjourned.

Special English Correspondence.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, January 10, 1912.

Detail in our Industry.—Is Gas a Primary or a Secondary Product?—Parliamentary Returns for 1910.

Some years ago the late Governor of the Gas Light and Coke Company remarked that the control of the affairs and operations of a large gas company was becoming more like a state department than an ordinary business, and at that time the modern developments of free slot fittings, maintenance of incandescent burners, and general control of supplying and fixing all kinds of appliances, instructing and advising customers, etc., were only just in sight. Things that were to a large extent prospective, are now realities, and even in a moderate sized gas undertaking the manager is called upon to control several different departments, comprising perhaps 10 to 20 workers in each, and much of the success attending the business must depend on skilled and orderly organization, a responsible head to each department, and a system of reports that enables the manager to keep in touch with anything and everything. I have just been looking to see what our technical journals have to say about the past year, the present position, and future prospects, and am impressed by the fact that the "Review," published in the *Journal of Gas Lighting*, extends to some 13 pages, and includes 28 different headings. Questions of finance, profits, buying and selling, claim 5 pages, illustrating the extent to which the departments comprised under the ter m of "the commercial end," have expanded. The subjects of carbonization, condensation, purification and distribution, are disposed of in a very brief space. Yet one can remember when these constituted almost the whole feature in an annual "Review." The paragraph on street lighting is interesting. There are not only several items, but it will be observed that there is considerable activity in each, showing that our industry is very much awake, and imbued with the hustle and bustle so characteristic of modern life, prevading not only our business, but also our recreations. Increased facilities for education are no doubt to some extent responsible for this. And while young men are urged to improve themselves in technical matters, there is room for more encouragement in the way of remuneration, or more evidence that preference will be given, in fitting positions, to candidates possessing technical ability. If a young man works several evenings a week for some years, and qualifies fully in technical details, he very rightly expects that his services will be assessed at a higher value, than those of a man possessing ordinary office or business capability only. Yet it often happens that a pushing man of good address, with the aid of personal influence, is able to get the front place. It is one thing to have technical ability, and another to know how to get the best price for it. But if those at the head of affairs do not think it worth while to seek out, utilize and adequately remunerate the best technical ability obtainable, one cannot hope that the best and brightest intellects will be attracted into the profession. Men of first-class ability, it should be remarked, do not need to answer advertisements, nor will they, as a rule, push themselves forward.

Prof. Vivian B. Lewes has now completed the course of lectures on the carbonization of coal to which I alluded last month. And one of his conclusions is somewhat to the effect that more attention might well be given to the quality of coke, sacrificing, if necessary, the yield of gas to some extent. It is no new thing for gas engineers to be told by scientists outside the profession, that they think too much of the yield of gas. The late Dr. Meymott Tidy entertained the opinion, that a sort of panacea for complaints, as to quality and purity of gas, was to be found by a limitation to the make per ton to not more than 9,500 cubic feet per ton of coal carbonized. Prof. Lewes aptly defines the object sought to be "Given a definite weight of coal, how can it best be used to avoid waste and secure the highest monetary return, whilst at the same time satisfying the requirements of the various classes of consumers." This is exactly the problem that gas engineers have followed consistently for the last half century, with the result that they have brought down the selling price some 50 per cent., paid full profits, and supplied an honest article hat has satisfied their customers. Possibly they might, by means of more thorough technical training, have gone one better. But there is too much tendency to regard the achievements of the past in the light of the facilities of to-day. The fair way of putting the question is not, what was the best course that should have been followed, say 50 years ago, as shown by our present state of knowledge; but what was the best available course as supplied by the state of knowledge at the time. We cannot blame the engineer for not applying, in 1860, methods and processes that were not thought out or discovered before the present century. And pure scientists are apt to forget that the gas works' manager has to keep his gasholders afloat, and to earn a dividend. The experience in connection with the first point during the past month, or for that matter during any winter season, would lead to considerable qualification of purely scientific methods of procedure, which are not always consistent with commercial success. With the experiences of the Coalite Company in view, gas engineers might well ask for more positive evidence as to a demand for a better quality of coke. Many of them, as it is, are able to realize a higher price for all the coke they have to spare, than they pay for their coal. It must be admitted that gas coke is not favored in the best rooms of the house. But is there any demand for a drawing room coke, at a price sufficient to cover any loss due to decreased yield of gas? The Coalite Company failed to find or to be able to create one. It is the primary duty of the gas engineer to supply gas at the lowest remunerative price, and to maintain a sufficient supply. To that end, he has followed the usual practice amongst manufacturers, of getting the highest possible duty out of each retort or bed of retorts. If a company build a set of coke ovens, or of smelting furnaces, the managers are expected to get the largest practicable yield of coke or of metal consistent with reasonable attention to questions of labor or of wear and tear. They reduce half speed and idle time to the lowest possible limit, and they would need very strong and very positive evidence as to the advantage, before following a 75 per cent.

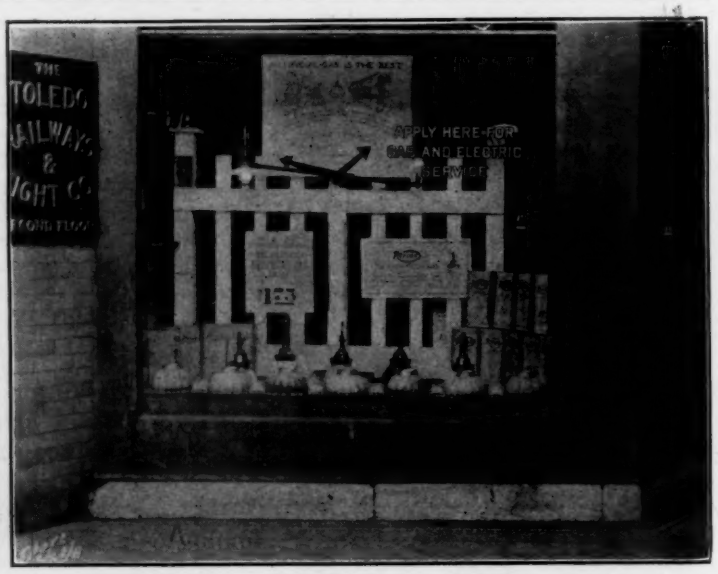
yield policy, which would mean for a given output, a proportionate increase in productive capacity and capital outlay. Following this lead, gas engineers will need much more evidence than is at present available before reversing their present policy, and instead of running gas and coke, taking up coke and gas.

It is a common reproach that gas engineers do not give sufficient attention to the coke trade, but an examination of the current prices reveals the fact that many, the majority, do not sell their coke badly. In several cases, I would venture to doubt whether a professional coke seller, if such an individual exists, could go into the district and do substantially better with it. A point has been made that the paper bag trade, the supply of 28-pound lots in tough paper bags, is new and rare. The practical man has to consider the cost of bagging up 80 parcels to the ton, which, together with the cost of the bags, will not be less than 3s. to 4s. This put the price per ton on the system, that renders it prohibitive except under special circumstances, such as a good class of residential flats. In country towns a street hawker having a donkey cart, can earn a comfortable living by distributing half-hundred lots in sacks and it will be a long time before he finds himself displaced in favor of the 28-pound paper bag. There are few works that do not run a mechanical breaker for the preparation of household coke, and many have put down a very complete screening and sorting plant. Some time ago it was a common custom amongst chairmen who wished to say something smart, to declare that the gas was sold at cost, and that the residuals paid the dividend. This stage has long been passed, and the receipts for residuals have attained something like double the amount of the annual dividend. Which goes to show that, as in the case of gas, the procedure of the past is not a showing to be ashamed of, though possibly capable of improvement.

The Parliamentary returns relating to gas undertakings in the United Kingdom, for the year 1910, have just been issued, and they show a satisfactory state of affairs. Sales of gas are well maintained, showing that the frantic efforts made by would be competitors have fallen flat. Particular attention has been directed to the vilification of the incandescent gas burner and of the gas cooker, just the articles that are most firmly established in the opinion of the public. The aid of scientific and medical evidence has not been wanting, and statements made 40 years ago have been hashed up. With all this in view, it is instructive to notice that some 250,000 names have been added to the consumers lists during the year, bringing the total to a figure not far short of 6½ millions, and that the output of gas has increased some 3 per cent. There is a very substantial increase in the number of public lamps. It is also evident that the term "coal gas" becomes more and more inaccurate every year. Something over 150 undertakings supplied carburetted water gas in proportions varying from 20 up to 55 per cent., while a still larger number own to the use of material other than coal, such as oil, crude petroleum, or benzol and other manufactured products. The public seem to have got over the carbonic oxide scare that was so much in evidence when water gas first came into use. There was some talk about a legal limit for that constituent, but the matter appears to have dropped, possibly because there have been no special casualties to draw attention to it. On this head it may be remarked that a more effective way of protecting the public from the effects of escaping gas, would be to prohibit the use of waterslide pendants, and to inaugurate a system of testing and inspecting the appliances and fittings. There is a demand for cheap stuff that is met by the use of poor quality metal, and light sections of pipes and connections. Looking at the rubbish that finds favor in some districts, one wonders that a case of gas poisoning is not a weekly event. In this connection some credit must be given to the introduction of the slot meter system, not the least advantage of which is that it ensures the use of fittings of a proper character, fixed in workmanlike style. Where the gas company supply and fix the pipes and fittings, there is some guarantee of a satisfactory job. They have no interest in the use of flimsy material.

Management & Commercial Methods.

A Toledo Example of How to Use a Show Window.—The gas division of the Toledo (O.) Railways and Light Company is under the direction of Mr. A. H. Gindele. He recently forwarded to us a photograph reproducing the appearance of a sample window display, made and maintained by the Company in connection with the gas division, the main object being to attract the attention of the passer-by, with a view to causing such to inquire as to the best way in which to use gas; not to misuse (or waste) it. The display cards carry matter plainly proving the saving in operation and the greatly increased illumination value secured through the use of a reflex, inverted gas lamp instead of the antique (though too frequently present) open flame gas tip. This window exhibit has attracted quite some attention; in fact, attention of the sort which resulted in creating a brisk demand for the reflex type. The rates in Toledo for gas supply are: Artificial gas for lighting, 95 cents per 1,000; for fuel, 70 cents; natural gas, 35 cents per 1,000. In closing his communication, Mr. Gindele remarks: "The use of gas in modern way is sure to accomplish results."



Display Window, Toledo Railways and Light Company.

Items of Interest
FROM VARIOUS LOCALITIES.

"J. C. R.," writing from Atlanta, Ga., to hand under date of the 18th inst., says: "I am sending you an acrostic that was written by Mr. Philmer Eves, Secretary of the Indiana Gas Association. It pertains to the boom for Atlanta in 1912 as the proper meeting place." The acrostic is as follows:

Atlanta greets you all! Our sunny Southern land,
To gas men everywhere extends the welcome hand!
Let every friend of GAS Atlanta's claims express,
And our convention then will be a grand success.
N. C. G. A.! Thy fame Atlanta will uphold!
Then, on to Atlanta. Young and old, remember
Atlanta wants you all!

One of the completest displays of gas for cooking, gas for lighting and gas for heating ever undertaken in this country, the exhibition being carried on in the office building of the Company, was that maintained by the Laclede Gas Light Company during the late holiday season. The show was made on the main floor of the Laclede Company's building, 716 Locust street, St. Louis, and it was the outcome of the joint efforts of General Manager Holman and the Manager of the Company's New Business Department, John J. Burns. The main display had to to do with lighting apparatus—artistic, useful and economical—the separate exhibits totalling 1,600 examples of arc lights, drop lights, dining room domes, etc., which were mainly of the Welsbach types. These were shown in actual operation, and the gas consumed in such displayings called for the use of 7,500 cubic feet per hour. The lighting times averaged 10 hours per day and the exhibition lasted 10 days. Meanwhile the Laclede folks sold hundreds of lamps, etc., much the greater percentage of which went into Christmas and New Year reminders.

Mr. James J. Donlan, Secretary and Manager of the Waverly (Ia.) Gas Company, and Mr. H. A. Morey, also a prominent resident of Waverly, are in consultation with the authorities of New Ulm, Ia., as to the desirability of establishing a water gas plant in that place. If satisfactory terms can be arranged, the work will be constructed early this year. The parties in interest assert that $50,000 will construct a suitable plant, making also ample provision for main laying. In case it was ultimately determined to extend the distributing systems to the adjoining settlements of Sleepy Eye and Springfield an additional $25,000 would be necessary.

At a recent meeting of the Board of Directors of the Hyattsville (Md.) Gas and Electric Company these officers were elected: President, Mr. Alten S. Miller; Secretary and Treasurer, Mr. Emile Guillaudeau.

MR. L. E. BUTLER, of Evansville, Ind., has been appointed General Manager of the Sterling (Ills.) Gas and Electric Light Company, vice Mr. Elmer E. Crawford, resigned.

AT the annual meeting of the Citizens Gas and Fuel Company, of Oxford, Pa., the officers elected were: President, Jas. D. Burn; Vice-President, D. H. Menough; Secretary, H. P. Passmore; Treasurer, George Gitt.

MR. GEORGE H. CHANDLER, at one time rather prominent in the affairs of the Peoples Gas Light Company, of Manchester, N. H., died at his home in Manchester the evening of the 15th inst. He was in his 43d year, having been born in Manchester, March 19, 1869. He was the only son of the late Henry Chandler, who was widely known in New England banking circles.

THE San Diego (Cal.) Consolidated Gas and Electric Company has underway an extension of its distributing system to La Mesa, going through the settlements of Beverly, Eucanto, Lemon Grove and Spring Valley, with a branch leading to Beverly. This means a 10-mile extension.

MR. WILLIAM H. BURROWS, President of the Middletown (Conn.) Gas Light Company, has been elected President of the Middletown Electric Light Company, vice Judge D. Ward Northrop, resigned. Judge Northrop's successor on the Board of Directors is Mr. W. W. Camp. The Judge will retain the place of Counsel to the Company.

"B. M. S.," writing from Hempstead, Long Island, under date of the 20th inst., says: "It will no doubt be of interest to your readers in this section, to know that another veteran in the ranks has responded to the last earthly roll call. The response was made the evening of the 17th inst., by Mr. William L. Pettit, who then passed away, at his home, 52 North Grove street, Freeport, Long Island, after a short illness. Deceased was born in Hempstead, Long Island, December 21, 1845, and, having graduated from the Queens County High School in 1862, he entered the service of the old Brooklyn Gas Light Company in 1865, as Junior Clerk, and eventually rose to a high position in its accounting department, and just prior to his retirement from the service of the Brooklyn Union Gas Company (the corporation that succeeded some years ago to the estates of the Companies that formed the Brooklyn Union), he was its Deputy Manager. Retiring from the Company's service in 1894, he settled in Richmond Hill, Long Island, and 6 years thereafter he made his home in Freeport. His wife and a son (Mr. Wm. C. Pettit) survive him. The funeral services were held in his late home the evening of the 19th inst., and later on interment was made in Greenfield Cemetery."

SECRETARY PARSONS, of the Cohoes (N. Y.) Gas Light Company, has certified to the Secretary of State that the Company's stock has been increased to $200,000.

AT the annual meeting of the Hartford City (Conn.) Gas Light Company, the officers elected were: Directors, S. R. Bertron, George Bullock, F. R. Cooley, George Roberts, Jas. H. Knight, Jno. T. Robinson, Jno. R. Hills, S. C. Dunham and E. B. Bennett; President, E. B. Bennett; Vice-President, George Bullock; Secretary-Treasurer, J. A. McArthur; Manager, B. W. Perkins.

ON the 19th inst., representatives of the Consolidated Gas Company, of New York, applied to the Public Service Commission, First District, for the right to purchase a controlling interest in the New York and Queens Electric Light and Power Company and also in the New York and Queens Gas Company. Commissioner Maltbie ordered that a hearing be held on the merits next Wednesday. The Companies named have their headquarters in Flushing, N. Y., and are going concerns whose properties adjoin the Consolidated Companies properties on the Northwest, and those of the Brooklyn Union Company on the West and Southwest. The territory is being developed for residential and business purposes with remarkable rapidity.

THE royalty paid by the Omaha (Neb.) Gas Company into the city treasury on account of gas sales in 1911, amounts to $33,228.89.

MR. H. ALLAN ODELL has applied to the Town Board of Islip, Long Island, for the right to construct a gas works for the continuous supply of gas to the settlements of Sayville, West Sayville and Bayport. He asks for a franchise to run for 25 years, and agrees to charge not in excess of $1.60, gross, or $1.50, net, per 1,000 cubic feet. He offers a bond in $2,500 to indemnify the places named against possible damage, with additional bond in $1,000 should he fail to be in readiness to furnish gas within 17 months from the issuance of the grant. Mr. Odell offers other "safeguards" in the premises; but as to the safety of his propositions in general the authorities might do well to inquire over the value of such by referring to or conferring with the authorities of the nearby village of Babylon respecting Mr. Odell's work in this connection, since 1909. Meanwhile the Patchogue Company's owners have petitioned for the right to extend its main system west to Blue Point, and as Blue Point is just east of Sayville, it would seem that Patchogue fairly has the right of way. In any event, were we concerned in the supply of gas to Sayville or the other places named, our decided preference would be for Patchogue as against the Odell combination.

THE new offices of the Home Gas Company, Salisbury, Md., have been opened in the Delmar section, on Railroad avenue, in the premises formerly occupied by the Dixie Realty Company.

MR. PHILANDER BETTS, Chief Inspector Utilities Division, through Mr. E. B. Annett, Gas Inspector for the Division, New Jersey Public Utility Commission, reports having examined the conditions which prevail in the supplying of gas to the residents of Keyport and Matawan, N. J., by the Standard Gas Company's works. He examined the pressure in the residence of Mr. Hand (by-the-way, Mr. Hand is pastor of the First Baptist Church of Keyport), and found "no indication of an excessive pressure, the gas also appearing to be of fair quality." It is further remarked that "Most of the appliances or fixtures in use at Keyport are of an obsolete type and are very inefficient; also, that the house piping was put in about the time the plant was built—over 61 years ago—and is now in very poor condition."

BIDS for the construction of the municipal gas plant for Albany, Ga., which were to have been opened last Tuesday, will be opened tomorrow. The postponement of the opening was occasioned through the unavoidable absence of Commissioner C. W. Tift.

"P. R. R.," writing from Sterling, Ills., under date of the 19th inst., incloses the following: "The employees of the Sterling Gas and Electric Light Company, as a token of their esteem and friendship for Mr. Elmer E. Crawford, former Manager of the Company, some evenings ago, presented him with a diamond stick pin and beautiful Masonic ring. The main figure in the latter is the Knights Templar emblem, flanked by the emblems of the Blue Lodge and the Chapter. The 20 employees of the Company have been working on the affair for some time. On the evening in question Mr. Crawford was summoned to Judge R. W. E. Mitchell's office, supposedly to transact some legal business. Upon putting in an appearance, he found a committee of the employees present. The speech of presentation was omitted, the committee, instead, tendered him the following letter with the gifts:

"'We, the employees of the Sterling Gas and Electric Light Company, bearing in mind your kindness to us, your ever pleasant treatment and the kind and careful consideration you always displayed toward us while we were in your employ, do by these small tokens wish to express to you our appreciation of you, as an employer of men. We wish hereby to express our great regret at your leaving the employ of the Sterling Gas and Electric Light Company, and wish to thank you for your kindness to us during the time we have had the pleasure of working for you. Although we regret to see you leave us, we with pleasure join in wishing you every success in any line which you may choose to take up.' Mr. Crawford was visibly affected, but recovered sufficiently to thank the employees, through the committee, for the tokens of esteem."

Recent Patent Issues.

Prepared for the AMERICAN GAS LIGHT JOURNAL by ROYAL E. BURNHAM, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 20 cents.

1,013,013. Means for Making Producer Gas from Liquid Hydrocarbons. H. A. Gine, Los Angeles, Cal., assignor of one-third to F. C. Nelles, same place, and one third to G. R. Harrison, San Diego, Cal.

1,013,083. Gas Regulator. R. H. Thomas, New York City; M. R. Thomas, executrix of said R. H. Thomas, deceased, assignor to R. H. Thomas, Inc., New York City.

The Market for Gas Securities.

The annual meeting of the Consolidated Gas Company was brought off in peace and plenty, and the only fly in the ointment was the fact that, while the total lighting business done showed an increase over that recorded for 1910, nevertheless the average use per consumer showed a loss—less than 3 per cent. The officers in calling attention to this, however, made no mention of the fact that the months of October, November and December were noteworthy for the number of clear days. The average hours actual of sunlight, as between these days and those of 1910, exceeded those of the latter by quite 6.2 per cent. The former officers were re-elected, and a dividend of 1½ per cent. was subsequently declared. The Company's position looks impregnable, though that party who knifed the Company before (his fellows call him "Tim." Sullivan), is asking the Legislature to put the selling rate for gas in New York city at 70 cents per 1,000.

Brooklyn Union is a trifle lower, and other outside shares are held at slight advances over the figures reported last week. The policy of the Leiter crowd in Washington, D. C., has sent those shares down 25 points thus far, and the end is not yet. Some new brooms seem to have the faculty of raising a dust that will not readily settle.

Gas Stocks.

Quotations by George W Close, Broker and Dealer in Gas Stocks.

115 BROADWAY, NEW YORK CITY.

JANUARY 29.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	Capital.	Par.	Bid.	Asked
Consolidated Gas Co.	$78,177,000	100	139⅝	140
Central Union Gas Co.—				
1st 5's, due 1972, J. & J.	8,000,000	1,000	103	105
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	105	106
Mutual Gas Co.	8,600,000	100	155	165
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	102	103
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	35	50
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	—	98½	100½
New York and East River—				
1st 5's, due 1944, J. & J.	2,500,000	1,000	103	105
Con. 5's, due 1945, J. & J.	1,500,000	—	95	100
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	94	100
Standard	5,000,000	100	60	70
Preferred	5,000,000	100	90	100
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	103	105
The Brooklyn Union	15,000,000	1,000	133	140
1st Con. 5's, due 1948, M. & N.	15,000,000	—	106¾	107
Yonkers	299,650	500	120	—
Out-of-Town Companies.				
Bay State	50,000,000	50	⅛	⅜
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	—
" 1st Mtg. 5's	509,000	1,000	97	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	59	60
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed Gold Bonds	7,680,000	1,000	104	106¼
Cincinnati Gas and Electric	29,500,000	100	87	90
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	96	98
Columbus (O.) Gas Lt. & Heating Co.	1,682,750	100	90¼	91
Preferred	3,026,500	100	75¼	80
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	13,460,084	—		—
Mortgages, 5's	3,400,000	—		—
General Mortgage 4½'s	10,661,000	—		—
Con. Gas Co., Baltimore City, 4½'s	2,751,000	—		—
Consolidated Gas Co. of N. J.	1,000,000	100	15	—
Con. Mtg. 5's	976,000	1,000	94	96
Bonds	75,000	—	—	100
Detroit City Gas Co.	6,580,000	—	—	50
Detroit Gas Co., 5's	881,000	1,000	75	80
" Prior Lien 5's	5,619,000	1,000	97	100½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	133	136
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co., 1st Mtg. 5's	1,350,000	1,000	100	101
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	—	130	138
" Bonds, 5's	10,500,000	—	104	106
Indianapolis	2,000,000	—	—	88
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	200,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	—	86
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede Gas Co., St. Louis.	10,000,000	100	106¾	107
Preferred	2,500,005	100	114	120
Bonds	10,000,000	1,000	102½	103
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,370,000	50	143	145
Madison Gas and Electric Co.				
" 1st Mtg. 6's	400,000	1,000	106	108½
Massachusetts Gas Companies, of Boston	25,000,000	100	90¾	91
Preferred	25,000,000	100	96	96¼
Montreal Gas Co., Canada	2,000,000	100	218	218¾
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	97	98
Bonds, 6's	6,000,000	—	127	128
New Haven Gas Co.	2,000,000	25	200	—
Peoples Gas Lt. & Coke Co., Chicago	25,000,000	100	105½	105¾
1st Mortgage	20,100,000	1,000	102	102½
2d "	2,500,000	1,000	104	—
Rochester Gas & Electric Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104¾	105½
acific Gas and Electric Co.	15,500,000	—	5 ⅜	55
St. Joseph Gas Co.—				
1st Mtg. 5's	1,000,000	1,000	96	98
St. Paul Gas Light Co.	2,500,000	100	—	—
1st Mortgages, 6's	650,000	1,000	104	105
Extension, 6's	600,000	1,000	112¾	115
General Mortgage, 5's	3,447,000	1,000	94	96
Syracuse Gas Co., N. Y.	1,975,000	100	50	55
Bonds	2,047,000	1,000	101	103
Washington (D. C.) Gas Co.	1,600,000	200	410	415
1st Mortgage, 6's	600,000	—	—	—
Western Gas Co., Milwaukee	4,000,000	—	—	—
Wilmington (Del.) Gas Co.	600,000	50	—	—

MEETING TIMES OF THE VARIOUS GAS ASSOCIATIONS.

American Gas Institute.—Annual meeting, October 16 to 18, 1912. Atlantic City, N. J. Officers: President, Ira C. Copley, Aurora, Ills. Secretary, Geo. G. Ramsdell, 29 West 39th st., N. Y. City.

Canadian Gas Association.—Annual meeting, ———— Officers: President, Arthur Hewitt, Toronto, Ont.; Secretary and Treasurer, John Keillor, Hamilton, Ont.

Empire State Gas and Electric Association.—Annual meeting, New York City, Oct. 1912. Officers: President, R. M. Searle, Rochester, N. Y.; Secretary, C. H. B. Chapin, 29 W. 39th street, New York City.

Guild of Gas Managers of New England.—Annual meeting, March, 1912. Young's Hotel, Boston; monthly meeting, second Saturday. Officers: President, Walter G. Africa, Manchester, N. H.; Secretary, H. K. Morrison, Brockton, Mass.

Illinois Gas Association.—Annual meeting, time, March 20 and 21, 1912, Auditorium Hotel, Chicago, Ills. Officers: President, C. B. Strohn, Elgin, Ills.; Secretary-Treasurer, F. E. Newberry, Dixon, Ills.

Illuminating Engineering Society.—Annual meeting, Sept. ————1912, ———— Meetings of Sections, monthly. Pres't, A. E. Kennelly, Boston, Mass.; Secretary, Preston S. Millar, 29 W. 39th street, N. Y. City. Sections: New York, Secretary, Albert J. Marshall, 16 East 40th street. New England, Secretary, H. C. Jones, 10 High street, Boston, Mass. Philadelphia, Secretary, L. B. Eichengreen, Broad and Arch streets. Chicago, Secretary, A. L. Eustice, 105 North Wabash avenue.

Indiana Gas Association.—Annual meeting, Jan., 1913, Indianapolis. Officers: President, Howard L. Olds, Indianapolis; Vice-President, Wm. Wallace, Lafayette; Secretary-Treasurer, Phimer Eves, Indianapolis.

Iowa District Gas Association.—Annual meeting, time, May, ——, 1912; Lincoln, Neb. Officers: President, G. W. Clabaugh, Omaha, Neb.; Secretary and Treasurer, G. I. Vincent, Des Moines, Ia.

Kansas Gas, Water and Electric Light Association.—Annual meeting, time, Sept. 1912. Manhattan, Kas. Officers: President, B. F. Eyer, Manhattan, Kas.; Secretary and Treasurer, J. D. Nicholson, Newton, Kas.

Michigan Gas Association—Annual meeting, time, Sept. ————1912;———— Officers: President, F. W. Blowers, Kalamazoo, Mich; Secretary-Treasurer, Glenn R. Chamberlain, Grand Rapids, Mich.

Missouri Electric Light, Gas, Water Works and Street Railway Association.—Annual meeting, April, 1912; St. Louis, Mo. Officers: President, F. E. Murray, Louisiana, Mo.; Secretary and Treasurer, N. J. Cunningham, Springfield, Mo.

National Commercial Gas Association.—Annual meeting, December, 1912. Atlanta, Ga. Officers: President, C. L. Holman, St. Louis, Mo.; Secretary, Louis Stotz, 29 West 39th street, New York City.

Natural Gas Association.—Annual meeting, May, 1912, Kansas City, Mo.; Officers: President, A. B. Macbeth, Independence, Kas. Secretary, T. C. Jones, Delaware, O.

New England Gas Association.—Annual meeting, February, 14th and 15th, 1912 Boston. Officers: President, J. A. Coffin, Gloucester, Mass.; Secretary-Treasurer, N. W. Gifford, East Boston, Mass.

New Jersey State Gas Association.—President, William H. Pettes, Newark, N. J.; Secretary-Treasurer, Arthur H. Osborn, Belmar, N. J.

Ohio Gas Association.—Annual meeting, February 6 and 7, 1913, Columbus, O.; President, John M. Garard, Columbus, O.; Secretary-Treasurer, T. C. Jones, Delaware, O.

Oklahoma Gas, Electric and Railway Association.—President, Noel R. Gascho, Alva Okla.; Secretary, H. V. Bozell, Norman, Okla.

Pacific Coast Gas Association.—Annual meeting, Sept. ————1912, ———— ——Officers: President, W. Baurhyte, Los Angeles, Cal.; Vice-President, Henry E. Adams, Stockton, Cal.; Secretary-Treasurer, John A. Britton, 445 Sutter street, San Francisco, Cal.

Pennsylvania Gas Association.—Annual meeting, Williamsport, Pa., April 8-10, 1912. Officers, President, C. W. Butterworth, Philadelphia, Pa; Secretary-Treasurer, William H. Merritt Lebanon, Pa.

Society of Gas Lighting.—Annual meeting, Dec., 13, 1912; monthly meeting, second Thursday. Place, New York City. Officers: President, Fred. S. Benson; Secretary, George G. Ramsdell, 254 West 39th street, New York city.

Southern Gas Association.—Annual meeting, April 17-19, 1912, Jacksonville, Fla. Officers: President, H. B. Hoyt, Jacksonville, Fla.; Secretary-Treasurer, E. D. Brewer, Atlanta, Ga.

Southwestern Electrical and Gas Association.—Annual meeting, April 27, 28, 29, 1912; Houston, Tex. Officers: President, J. E. Carroll, Beaumont, Tex.; Secretary, D. G. Fisher, Dallas, Tex.

Wisconsin Gas Association.—Annual meeting, May 15 and 16, 1912, Milwaukee, Wis. Officers: President, H. M. Buck, Waukesha, Wis.; Secretary-Treasurer, Henry Harmon, Milwaukee, Wis.